DOCUMENT RESUME

ED 323 216 TM 015 387

AUTHOR Jenkins, John M.; And Others
TITLE Learning Style Profile Handbook: I. Developing Cognitive Skills.
INSTITUTION National Association of Secondary School Principals, Reston, Va.
PUB DATE 90
NOTE 84p.
AVAILABLE FROM National Association of Secondary School Principals, 1904 Association Drive, Reston, VA 22091-1598.
PUB TYPE Guides - Non-Classroom Use (055) -- Tests/Evaluation Instruments (160)

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Classification; Cognitive Processes; *Cognitive Style; Cognitive Tests; Discrimination Learning; Guides; *Learning Processes; Memory; Secondary Education; *Skill Development; Spatial Ability; Student Evaluation; Test Use; *Thinking Skills
IDENTIFIERS *Learning Style Profile (NASSP)

ABSTRACT

The National Association of Secondary School Principals (NASSP) published a new learning style instrument in 1986--the NASSP Learning Style Profile (LSP). The LSP yields independent scores on 24 discrete elements of learning style. Its purpose is to provide educators with a well-validated and easy to use instrument for diagnosing cognitive styles, perceptual response tendencies, and study and instructional preferences of middle level and senior high school students. The LSP offers school practitioners a way to personalize the instructional process, identify the dominant stylistic characteristics of students, and plan instruction accordingly. This practical guide presents exercises to enhance the cognitive skills diagnosed by the LSP. The exercises, which draw on sample items from the LSP, are designed to augment each of the following areas: (1) analytic skill; (2) spatial skill; (3) discrimination skill; (4) categorization skill; (5) sequential processing skill; (5) simultaneous processing skill; (6) memory skill; and (7) verbal-spatial preference. Grade-level designations are listed for each activity. Appendix A provides a key to complicated performance activities, and Appendix B presents a LSP interpretation form. (SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

T. KOERNER

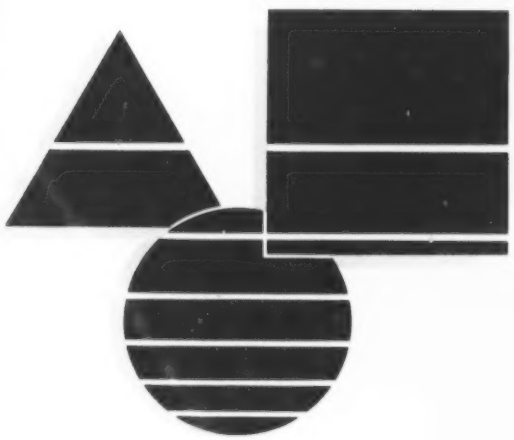
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED323216

LEARNING STYLE PROFILE

I. DEVELOPING COGNITIVE SKILLS

HANDBOOK



John. M. Jenkins
Charles A. Letteri
Patricia Rosenlund

NATIONAL ASSOCIATION OF SECONDARY SCHOOL PRINCIPALS
RESTON, VIRGINIA

TM015387

LEARNING STYLE PROFILE HANDBOOK: I. DEVELOPING COGNITIVE SKILLS

John M. Jenkins
Charles A. Letteri
Patricia Rosenlund

About the Authors:

John M. Jenkins is the director of the P. K. Yonge Laboratory School, University of Florida, Gainesville and a Learning Style Network board member.

Charles A. Letteri is associate professor of educational psychology and director of the Institute for Research on Teaching and Learning Skills at the University of Vermont. He is a contributing co-author of the NASSP *Learning Style Profile*.

Patricia Rosenlund is a resource teacher, Alamo Elementary School, El Paso, Texas, and a former cognitive skills teacher for middle and senior high levels at the P. K. Yonge Laboratory School.

Executive Director: Timothy J. Dyer
Director of Publications: Thomas F. Koerner
Technical Editor: Eugenia Cooper Potter

All Rights Reserved
Copyright 1990
National Association of Secondary School Principals
1904 Association Drive • Reston, Virginia 22091
(703) 860-0200

CONTENTS

Foreword v

Introduction viii

Analytic Skill 1

Spatial Skill 9

Discrimination Skill 17

Categorization Skill 27

Sequential Processing Skill 35

Simultaneous Processing Skill 41

Memory Skill 47

Verbal-Spatial Preference 59

References 65

Appendix A: Key to Performance Activities 67

Appendix B: Profile Interpretation Form 75

FOREWORD

The National Association of Secondary School Principals, with the assistance of a distinguished national task force, published a new learning style instrument in 1986—the NASSP Learning Style Profile (LSP). The Profile is second-generation technology, building on the research and design of earlier work in the field. Its purpose is to provide educators with a well-validated and easy to use instrument for diagnosing the cognitive styles, perceptual response tendencies, and study/instructional preferences of middle level and senior high school students. The Profile offers school practitioners a way to personalize the instructional process, to identify the dominant stylistic characteristics of students, and to plan instruction accordingly.

The Learning Style Profile opens up new avenues for principals, teachers, and students to create caring and effective schools, places where learners and learning are important, where every student can be reasonably successful in acquiring the knowledge and skills necessary for a productive life. Many of the instructional implications of differing student styles have yet to be investigated, but one thing is certain. Students who understand their learning styles and who exercise active control over their cognitive skills do better in school. They are better adjusted, have more positive attitudes toward learning, and achieve at higher levels than their less skillful peers.

The Profile provides, for the first time, easily usable information on the cognitive elements of style, as well as measures of perceptual, affective, and environmental styles. (See Figure 1 for the relationships among the various LSP subscales based on a human information processing perspective.) Cognitive controls (styles) are internal to the human information processing system and are instrumental in all learning. If a student has good cognitive skills, he or she is ready to learn efficiently and successfully. If a student lacks these skills, frustration and failure are the likely outcomes. Volume I of this handbook provides activities that are useful in enhancing cognitive skills.

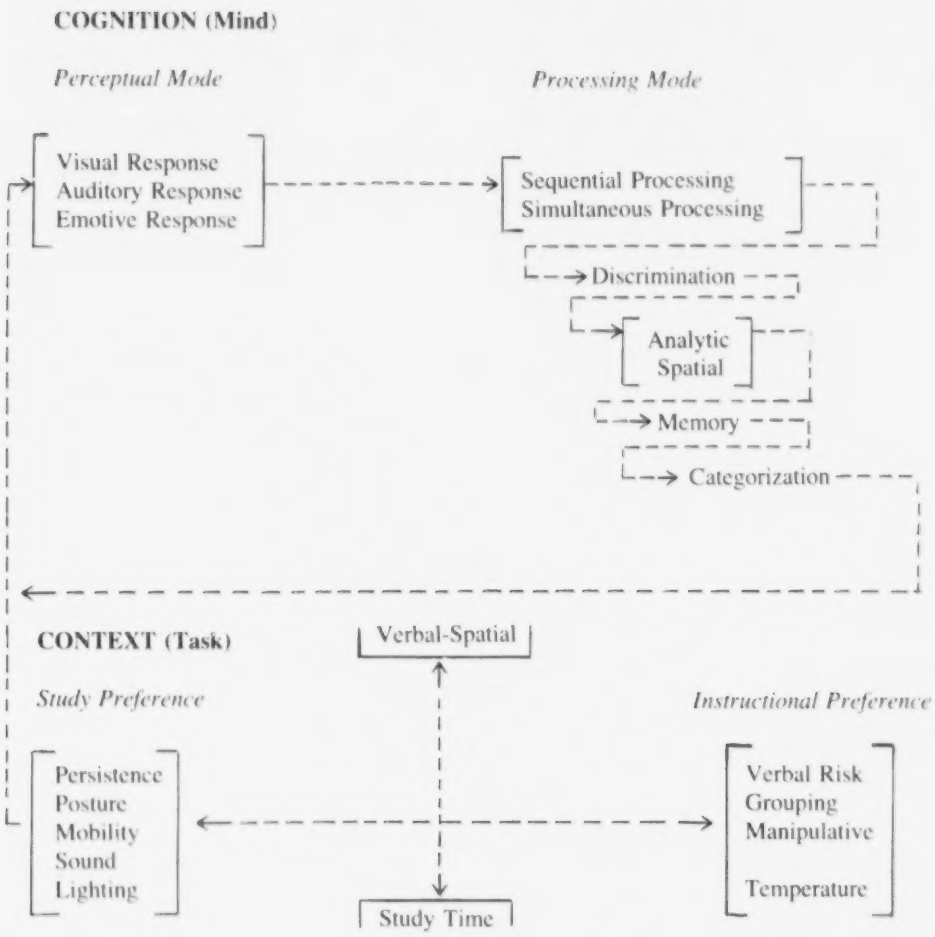
Much of the recent learning style literature has emphasized the perceptual, motivational, or environmental aspects of style. Various ways to adapt the learning environment to these learner needs and preferences are presented in Volume II of the handbook. These strategies and activities are based on the field work of educators with wide experience in innovative schools. They are keyed to the perceptual, study, and instructional elements of the Profile.

The reality, however, is that students with weak cognitive skills will benefit little from an analysis and matching of these other style elements. If students cannot process information effectively, even supportive learning environments will be of little value to them. Fortunately, cognitive skills can be strengthened. The exercises in Volume I of the handbook are designed to support cognitive augmentation or training.

The cognitive elements, then, are the starting point. We are grateful to John Jenkins, Charles Letteri, and Patricia Rosenlund for giving us a practical guide that makes cognitive skills enhancement a real possibility in the school and classroom setting. Thanks also are extended to Marlin Languis of the Ohio State University who reviewed Volume I, and David P. Cavanaugh, LSP Training Coordinator, who reviewed Volume II. Maryellen Parker, NASSP research associate, assisted with the research for Volume II.

James W. Keefe
NASSP Director of Research

Figure 1. NASSP Learning Style Profile Subscale Relationships Based on a Human Information Processing Model (James W. Keefe, 1988)*



*Note: The relationships among perceptual response subscales and cognitive controls are based on typical human information processing patterns. The individual responds to external or internal stimuli (perceptual mode), and the information is automatically processed both sequentially and simultaneously. The individual exercises personal preference in processing mode to discriminate among sequential and simultaneous data. The data are further subjected to analytic and spatial controls, held in short-term or working memory, and then categorized in long-term memory (or rejected). This processing all takes place in the context of verbal-spatial, study, and instructional preferences. The relationships among the later subscales are based on a second order factor analysis conducted by the Learning Styles Task Force. Verbal-Spatial preference is placed between cognition and context because it loaded with the cognitive styles in this analysis but relates to the context. Study time preferences are listed between study and instructional preferences because they cross loaded in the analysis. (See the LSP Technical Manual for more detail.)

INTRODUCTION

In the fall of 1986, the National Association of Secondary School Principals published the *Learning Style Profile* (LSP), the newest and most sophisticated learning style diagnostic instrument available for use in secondary schools. The instrument was the work of a task force of learning style theorists and practitioners who have worked in the area of learning style for many years. The final product was the result of four years of exhaustive study and analysis.

The LSP yields independent scores on 24 discrete elements of style. The elements are clustered into *cognitive skills, perceptual responses, and instructional and study preferences*. The student profile provides diagnostic information that can be used in planning and executing instructional strategies for individual students and groups of students.

Of the areas examined by the LSP, the cognitive skills are ostensibly the most authoritative, if one considers the number of years researchers have investigated them. Yet, despite this experience, few specific strategies are available for school personnel to augment or remediate student weaknesses in one or more of the cognitive elements. Some clinical activities exist for helping individual students, but these activities have not been available in one source such as this nor have they been adapted for subject use by classroom teachers.

The augmentation or remediation of cognitive skill weaknesses can be accomplished in two different ways. Schools can establish a clinical center with one teacher trained as a cognitive resource teacher to work with students in small groups or one-to-one. Schools can also train classroom teachers in specific subject areas to help individuals or small groups strengthen cognitive skill weaknesses.

The purpose of this handbook is to provide school personnel with practical suggestions that have been used in both settings. They are the work of one teacher in particular, Patricia Rosenlund, with input from several others who have worked with students in the P. K. Yonge Laboratory School, University of Florida, Gainesville. The practices are based on the work of teachers and clinicians and the research of cognitive psychologists.

The clinical activities developed by Charles A. Letteri for the cognitive skills of analysis, discrimination, categorization, and memory served as the basis for several of the activities in this handbook. Dr. Letteri heads a clinic in Burlington, Vermont, whose purpose is to augment cognitive skill weaknesses in children ages 6–18. He also assisted in the development of the cognitive skills laboratory at the P. K. Yonge Laboratory School. James W. Keefe, NASSP research director, and Marlin Languis of Ohio State University developed or adapted several of the activities for the areas of analytic, spatial, discrimination, and categorization skill.

The activities should be used with consideration. Further validation is needed to establish their potential to enhance specific skills in students of different ages. We hope that, as these activities are understood and used with students, they will suggest other strategies with meaningful applications in the various subject areas.

The exercises in this handbook are designed to augment each of the following elements:

ANALYTIC SKILL
SPATIAL SKILL
DISCRIMINATION SKILL
CATEGORIZATION SKILL
SEQUENTIAL PROCESSING SKILL
SIMULTANEOUS PROCESSING SKILL
MEMORY SKILL
VERBAL-SPATIAL PREFERENCE

Grade level designations have been listed for each activity based on our prior experience. These grade level designations can be adjusted as teachers see a need for legitimate variations with individual students.

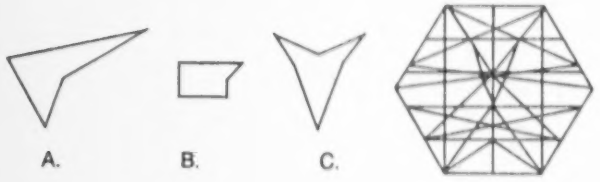
John M. Jenkins
P. K. Yonge Laboratory School, 1989

ANALYTIC SKILL

Definition: To identify simple figures hidden in a complex field: to use the critical element of a problem in a different way. (From *Learning Style Profile: Examiner's Manual*, p. 5) The skill of analysis requires that the student break down an idea, concept, or problem into its component parts and then put it back together again. The purpose of analysis is to get a closer look at some complex notion by looking at the salient parts. The analytical person also comprehends the whole object or task, because he/she sees the individual parts that make up the whole.

Sample Items from the LSP

One of the forms below is hidden in the complex figure. The hidden form is the same size, same shape, and facing the same way as one of the forms below. Select the correct hidden form.



Simple Forms

Complex Figure

These items are similar to items found in the *Embedded Figures Test* and *The Group Imbedded Figures Test* developed by Herman Witkin et al. (1962).

Research Base

Witkin wrote of people being field dependent or field independent based upon their ability to locate a familiar figure located in a complex design. Field dependent people find it difficult to overcome the influence of the surrounding field or to separate an element from its context. Field independent people do not. They can attend to the familiar object without reliance on the prevailing field.

Witkin observed that young children tend to perceive in a relatively field dependent fashion, but as they grow older they become more field independent. In this sense, his findings are similar to those of Piaget (1947) who used the term "global" to describe the perceptual behavior of children and the term "analytical" to describe the perceptual behavior of older children and adults.

Pemberton (1952) stated that field independent subjects were interested in "analytic" endeavors. Thus, a connection was made between field independent behavior and the cognitive skill of analysis. The converse, that field dependent subjects were less analytic, could thus be inferred.

It would seem that the tendency toward analysis is a cognitive characteristic more likely to be found in intellectually mature people than in the less mature. Thus, students who possess the skill of analysis would seem to do better in school. The analytic skill subscale measures analytic vs. nonanalytic behaviors (contradictories). Learners who are more analytic also often tend to be global (the opposite behavior) in that they are able to perceive the parts of a problem and to reconstruct the whole.

Introduction of Analysis to Students: The purpose of analysis is to get a closer look at a complex task by examining the component parts. Students who do not employ the skill of analysis may have difficulty recognizing individual items within a given problem or may not know how to begin or proceed through a task.

In training for analysis, begin with a verbal and written definition of the skill. You may want to use a simplified version of the definition:

Analysis–breaking something into its basic parts, in order to solve a problem.

Introduce examples of analysis:

1. Sorting everyday items such as clothes, silverware, foods, tools, etc.
2. In mathematics, breaking fractions into their component parts.
3. In English, identifying words as parts of speech and/or salient facts (e.g., names, places, objects).
4. In social studies, breaking a map into component parts for naming or labeling (e.g., countries, latitude, climate zones, various symbols).

Have students identify things that they do analytically. Ask them how analysis might be helpful in completing tasks or solving problems. Treating problems analytically is not the only way to solve them, but it is an approach that can assist students in solving problems efficiently.

The following practice activities develop a step-by-step approach to completing a task. The content examples show how analysis can be used in all classroom activities.

Audience Level: 6th–12th Grade

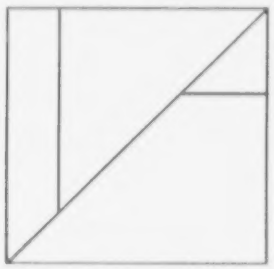
Cognitive Skill: Analysis

Practice Activity: Identifying and Labeling

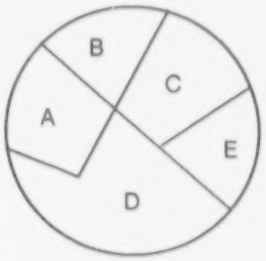
Objective: To recognize parts and combinations of simple figures.

Procedure: Use the following warm-up activities as a way of introducing students to the skills of analysis—breaking down a task into its component parts.

1. Look at the square. Label each of the parts. Draw each part separately.



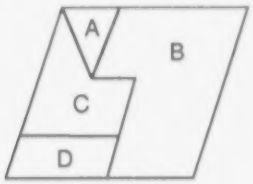
2. Look at the circle. Draw the parts that match the letter combinations below.



AC BCE ACDE

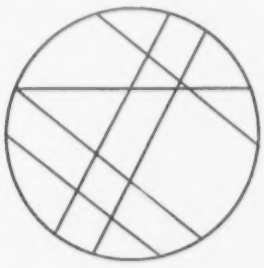
DC ACE ABCD

3. Circle the letters of the parts of the complete figure that make the shapes below:



A B C D A B C D A B C D

4. Label each part of the circle. Draw each part separately.



Audience Level: 6th–12th Grade

Cognitive Skill: Analysis

Practice Activity: Writing Directions

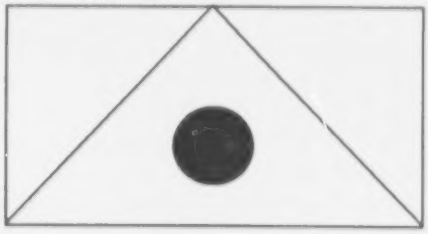
Objective: To critically examine a figure and systematically break it down into parts.

Materials: An activity worksheet for each student.

Procedure: Provide each student with an activity worksheet. In the first box students are to examine the figure and write a set of directions for drawing that figure. Encourage the practice of numbering the directions and using words that communicate precise information. In the second box students have the opportunity to draw their own figures and write the directions for them. Students may want to read the directions to a partner to see if they effectively communicate the information.

Analytic Skill: Writing Directions

Closely examine the design below. Write a set of directions for drawing the design.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Draw your own design in the space below. Write the directions for drawing the design in the space below. Trade papers with a partner and see if he/she can use your directions to accurately draw the design.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Audience Level: 6th–12th Grade

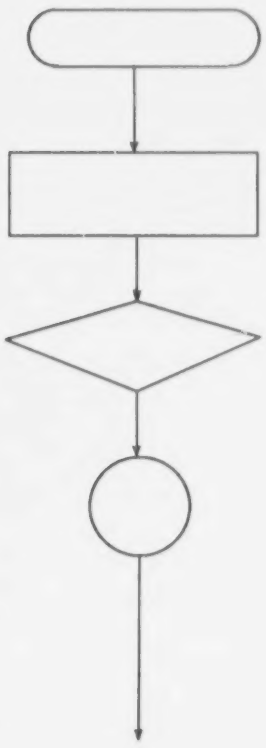
Cognitive Skill: Analysis

Practice Activity: Flowcharting

Objective: To break down a task systematically into logical steps.

Procedure: Introduce flowcharting as a way to break down a task into steps. A flowchart is a diagram that represents a sequence of events. It can be an effective way to write directions, picture stages, show cycles, and teach a new skill. Begin with an example of a task that the class can break down as a group. One possible task might be "How To Make a Phone Call" (Black and Black, 1985).

Teach the common symbols to use as you complete the example:



used for "start" and "stop"

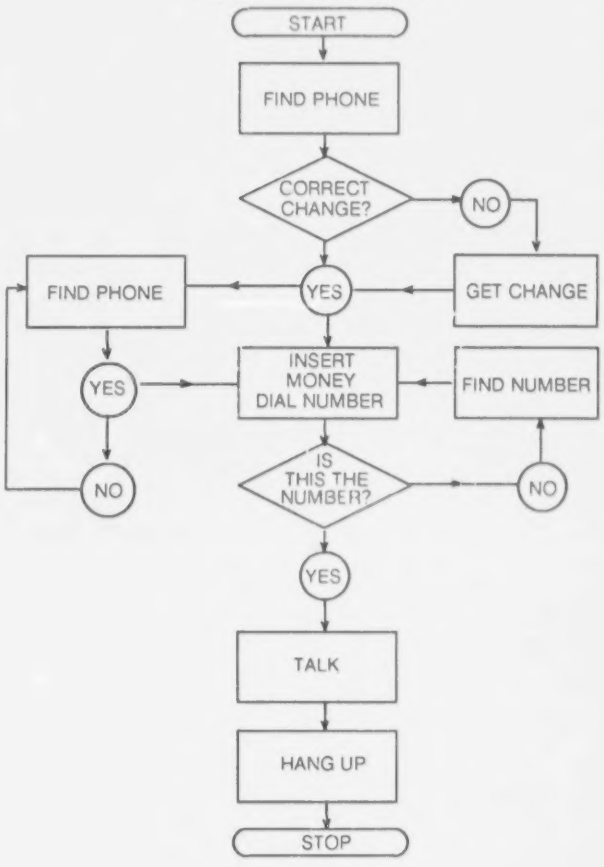
used for actions or activities

used for questions at decision points

used for answers at decision points

used to show direction and sequences

FLOWCHARTING A SEQUENCE
Steps in making a phone call::



Audience Level: 7th—9th Grade

Cognitive Skill: Analysis

Content Application: Science—THE SCIENTIFIC METHOD

Objective: To diagram the steps of the scientific method.

Materials: Science textbook or written information on the scientific method.

Procedure: Review the symbols used in flowcharting and instruct the students to diagram the logical steps of the scientific method. This flowcharting system can be utilized for conducting scientific investigations throughout the year. By using this format, the students can analyze any title of study and proceed through the steps to record their findings. They can develop a similar cognitive network for any subject matter that requires analysis.

Example: The Scientific Method

The goal of science is to establish principles through a logical, organized method of study called the **scientific method**. Many different procedures are part of the scientific method, but all of them draw on a series of logical steps.

The first step in the scientific method is to identify the problem. For example, a scientist might be interested in acid rain. This pollutant forms when chemicals released by cars and factories mix with moisture in the air and fall as rain. A scientist might be curious about the effect of acid rain on wildlife. Investigating all the animals that make up "wildlife" would be impossible. Instead, the scientist would focus on a smaller group of organisms. The researcher might pose the question, "Does acid rain affect the development of salamanders?"

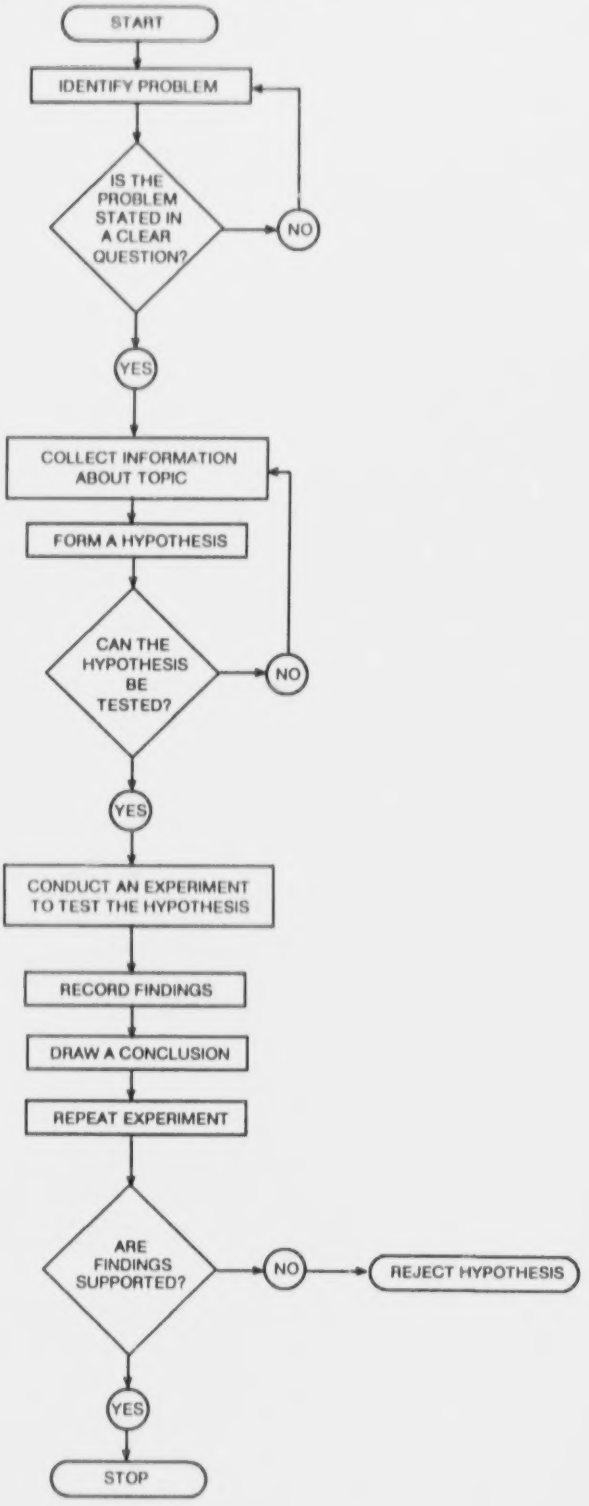
After stating the problem as a clear question, the scientist collects information in books and journals. He or she then develops a hypothesis, which is a proposed answer to the question. The hypothesis can be based on information available to the scientist. It can also be an educated guess. The hypothesis is a statement that can be tested.

Next, the scientist tests the hypothesis to see whether it is supported by evidence. The test of a hypothesis is an experiment. To be valid, this experiment must be designed in such a way that other scientists can repeat it. In order for an experiment to be reproduced by other researchers, a scientist must keep careful records. These records must state how the experiment was planned, how it was carried out, what equipment was used, and how long it took.

The answer to a scientific question is formulated by drawing a conclusion based on data, which are scientific facts collected during the experiment. Before presenting a conclusion to the scientific community, a scientist retests the hypothesis several times. Later, other scientists repeat the experiment until the hypothesis and the conclusions are supported or rejected.

(Adapted from *Biology*, Goodman et al., 1986.)

Analytic Skill: Scientific Method



Audience Level: 6th–12th Grade

Cognitive Skill: Analysis

Content Application: English/Writing

Objective: To apply analytic skill to a writing assignment by looking at an issue, topic, or object from a new perspective.

Procedure: Write a statement on the chalkboard.

Example: Every male at age 16 should serve one year in a military training program.

Form small groups and assign the task of writing three paragraphs in support of the statement and three paragraphs against the statement. Bring the entire group together and generate a class list of pros and cons for the issue.

Optional Procedure: Choose a vacation.

Present the two vacation packages listed below and ask students to pick the vacation they would prefer to take (record who picks which vacation). Assign everyone the task of writing a travel brochure promoting the vacation he/she did *not* choose.

Vacation Package #1:

A mountain climbing expedition with seven of your friends and an experienced guide.

Vacation Package #2:

A stay at a tropical island beach resort with two of your friends.

Note: Both writing assignments are intended to promote brainstorming and analytical thinking.

Audience Level: 6th–12th Grade

Cognitive Skill: Analysis

Content Application: Social Studies—MAP SKILLS

Material: A map for each student or pair of students. Develop a worksheet that assists students in preparing written directions from one place to another.

Procedure: Orient students to the symbols on the map (mileage chart, borderlines, etc.). Have each student locate the point to begin the directions and establish guidelines for the trip; i.e., map the fastest route or the most scenic route. Model the first direction and then allow independent work time. After everyone has completed the activity, share the results with the group and compare the different ways that directions can be communicated. Have students determine which words seem to communicate the information most effectively.

Audience Level: 11th–12th Grade

Cognitive Skill: Analysis

Content Application: American History

Procedure: Divide the class into groups of three to seven students. Appoint one student in each group as facilitator and one student as recorder. Ask the group to read the selections below and to respond to each of the questions. The purpose of this activity to get students to analyze the material and to respond to several thought provoking questions. Allow enough time for the students to read the selections, discuss their answers to the questions, and arrive at a consensus for each of the four questions. Discuss the answers by having spokespersons for each group share the group's answer to each question. The teacher should serve as the facilitator for the total group discussion.

Note: It is best to provide a short preliminary training session for group facilitators so that they can learn the techniques to help all persons in their groups to participate.

Example: Puritanism in New England

When the Puritans dropped anchor in Massachusetts Bay in 1630, they brought with them, like the Virginians, an Old World heritage of values and institutions.

Unlike the Virginians who initially sailed to America in search of precious metals or profitable raw materials for their English investors, the Puritans came as unrepentant religious refugees. While the Virginians officially established the Church of England, the Puritans rejected the official English church and established in Massachusetts a Calvinist, Puritan faith that expected spiritual perfection in both church and state.

From this stem, demanding faith soon evolved a church largely independent of both Old World ties and religious hierarchy, as they imagined the earliest Christian church to have been. A Puritan meetinghouse was built in each town where the local Puritan "Elect" saw to it that both church and town government were administered according to the precepts of Puritan perfectability. This meetinghouse functioned as a church, town hall, and often as a school so that children would be able to read the Bible. It was the union of religious and secular affairs that made seventeenth century Massachusetts a theocracy, a strange throwback to imagined New Testament times and a state of affairs that would grow increasingly out of place in the new land.

Unlike the London Company, which expected to profit from its Virginia venture, the Massachusetts Bay Company was more concerned with finding a haven for Puritan dissenters. Another difference was that the officers of the Massachusetts Bay Company sailed to America clutching their character, determined to remain and personally oversee their "City Upon a Hill." Despite their stern religious principles, this difference in the two colonies made the government of Massachusetts a model that the Virginia House of Burgesses used.

Just as in Virginia, Massachusetts Bay struggled for decades with serious Indian problems. Expanding inland, Puritans inevitably faced increasingly hostile contacts with tribes who refused to sell or be robbed of additional lands. Indeed, a major reason for the banishment of Roger Williams, besides his religious dissent, was his insistence on paying American Indians for their land. Defeated Indians were either killed, sold into slavery, or forced into the Western wilderness. No force seemed able to prevent the spread of a technologically stronger culture.

What changed Massachusetts from an elitist, Puritan theocracy with only nominal ties to England, to a secular, royal colony by 1700? One reason was political: after the defeat of the Puritan Commonwealth in England, the king wished to assert his royal prerogative in Massachusetts as his predecessors had in Virginia. In addition, the rise of a practical, successful merchant class, the spread and isolation of western settlements, and the doubts and decreasing religious fervor of the sons and daughters of the Elect brought about a decline in the perfectionist Puritan faith and influence.

By 1700, then, Massachusetts was a royal colony with an elected assembly chosen by propertied, but no longer necessarily Puritan, male voters. The Puritan theologian, Increase Mather, predicted that "New England will be the woefulest place in all America." But New England did not burn in Mather's Hell; and this may be attributed, perhaps, to the growing participation of men in the affairs of town and colony and the parallel growth of new and distinctly American ways of thinking.

Questions:

1. Why do you think the early Puritans rejected the official Church of England?
2. How was the Puritan search for religious perfectionism reflected in their form of government, their religious zeal, their attitude toward education, and their attitude of dissent?
3. What forced the Puritans to be practical in spite of their desire for perfectionism?
4. If you were a Puritan, how would you respond to the charge of mistreatment of the American Indians?

(Adapted from Polly Chase Cleary, Sarah Madison, and Charles Mitsakos, *Study America*. New York: Bantam Books, 1976, pages 38–40.)

Alternate Topics: Topics for case studies are many.

In English/language arts, a character analysis might be developed for short stories and novels. *In science*, accounts of original experiments can be wonderful sources for student analysis. *In social studies*, analyzing the motivations of the lead players in video sitcoms can create interest for most students.

Audience Level: 6th–8th Grade

Cognitive Skill: Analysis

Most of the activities and assignments that students are asked to do require the use of analysis. When presenting a concept, students can emphasize analysis by a *step-by-step* presentation of the subject matter and a systematic approach to the task.

Content Suggestions:

Reading

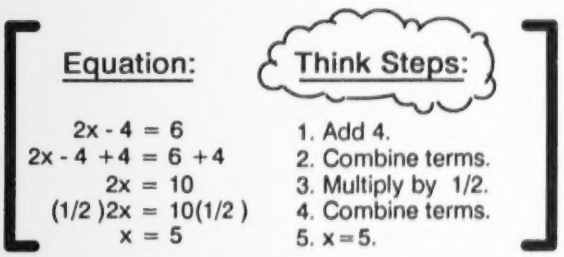
1. Break words into syllables, prefixes, and suffixes to decode or define each word.
2. Examine the parts of a paragraph by identifying the main idea and supporting details.
3. Extract the important parts (events) of a story and arrange them on a timeline.

Writing

1. Use pre-writing activities to closely examine individual concepts and to better understand the subject.
2. Break a business or friendly letter into component parts to examine their purpose.

Math

1. Break down word problems to determine the appropriate steps to solve the problem.
2. Step by step, focus on the procedures required to complete an equation.



Social Studies

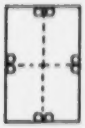
1. Break down the major events of a historical confrontation (World War I, World War II, American Revolution).
2. Examine individual historical concepts to better understand their meaning and to show their relationship to other concepts (e.g., industrialism, poverty, freedom, communism, democracy).

SPATIAL SKILL

Definition: To identify geometric shapes and rotate objects in the imagination; to recognize and construct objects in mental space. (From *Learning Style Profile Examiner's Manual*, p. 5) Students with strong spatial skills are able to visualize an object from different perspectives. They are able to attend to more aspects of that object because they see it from different viewpoints. By rotating the object in their mind's eye, the stronger spatial students can see distinguishing characteristics that other students miss. Because they have a better picture of the object or idea, they can better see where it fits into categories of information they already possess. Strong spatial learners can create spatial models to represent concepts. They have the ability to identify replicas of a geometric pattern. They see key elements when objects are represented spatially and can recognize these same elements in different settings.

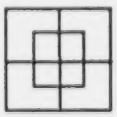
Sample Items from the LSP

These squares will fold into a box which is open at the top. Which letter would mark the BOTTOM of the box?



This sheet of paper has holes in it. How will the paper look if folded on the dotted lines?

How many squares can you find in the shapes below?

39.  A.6 B.8 C.10 D.12 E.14

40. A.9 B.10 C.12 D.13 E.14

Research Base

On the basis of factor analytic studies, spatial skills can be characterized in terms of two major components, *spatial orientation* and *visual representation*. *Spatial orientation* refers to an individual's frame of reference, the point in space from which he or she perceives the environment and the information in that environment (French, Ekstrom, and Price, 1963). In one view, it is based on certain inherited behavioral proclivities (Harris, 1981). *Visual representation* refers to the individual's ability to picture the movement of objects in space, very often three-dimensional space (French, Ekstrom, and Price, 1963). Sex differences in spatial skill have been found in numerous studies (Harris, 1981). It has been reported that males excel in rotational tasks (Metzler and Shepard, 1974) and in the folding of a two-dimensional geometric pattern into a three-dimensional figure (Bennett, Seashore, and Wesman, 1959). Males also show superiority in a sense of direction or way finding (Harris, 1981).

Whether or not spatial skills are amenable to change has been investigated by a number of researchers with varying conclusions. What is known, however, is that regardless of differences attributed to sex, many males and females in the middle of the distribution have like skills. There is also reason to suspect that, as children grow older, the differences in spatial skill recorded earlier in life are reduced even if not entirely eliminated (Sutton-Smith, 1977; McGuiness, 1976).

Strong spatial skills are likely to support success in mathematics, geography, chemistry, and physics.

Introduction of Spatial Skill to Students: This skill involves visual processing whereby the student visualizes a change in perspective. It is important initially to observe students' spatial performance to determine if they have spatial deficits or are merely approaching problems ineffectively.

When introducing spatial skills, begin with the definition. Provide students with a verbal and written explanation of the skill.

Introduce examples of spatial skills, such as:

1. Arranging figures in a given space.
2. Building a model and assembling objects.
3. Examining something from several perspectives.

The generic activities below provide practice in the use of this skill; the content examples demonstrate how spatial skills are inherent in many classroom activities.

Audience Level: 6th–12th Grade

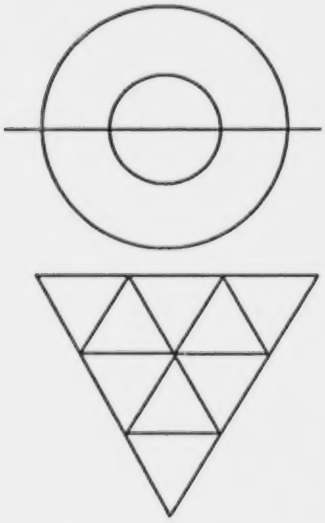
Cognitive Skill: Spatial

Practice Activity: Spatial Thinking

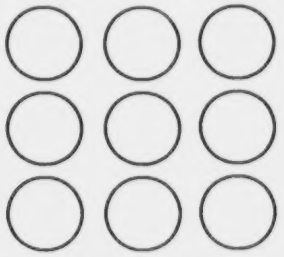
Objective: To help students approach spatial tasks in non-linear ways of thinking.

Materials: A copy of this worksheet for each student.

Procedure: Without lifting the pencil off the paper or retracing any lines, trace over these figures.



Connect the nine circles below by drawing only three lines, without lifting your pencil.



Audience Level: 6th–12th Grade

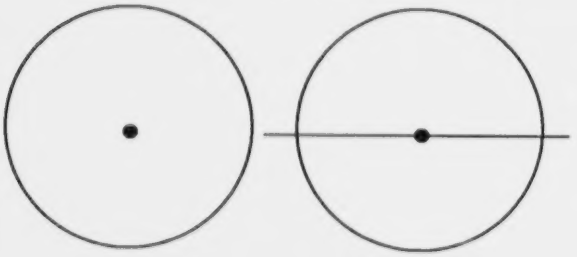
Cognitive Skill: Spatial

Practice Activity: Line Symmetry

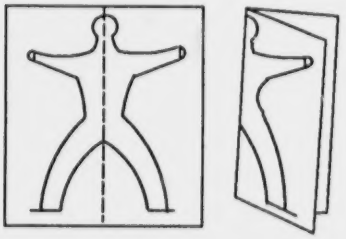
Objective: To alert students to the concept and some examples of line symmetry.

Materials: A copy of this worksheet for each student. Have several small mirrors available for demonstration and sharing.

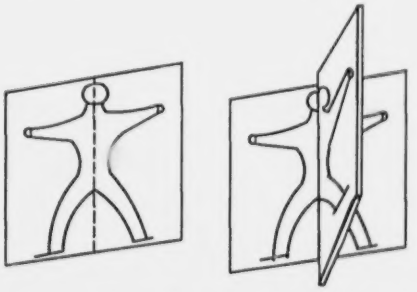
Procedure: The circle is the most symmetric of all two-dimensional figures. Any line through the center of a circle is a line of symmetry.



A good test of whether a two-dimensional figure has line symmetry is to fold the figure along the assumed line of symmetry. The figure is symmetrical if each line of the figure on one side of the fold matches the corresponding line on the other side.



You can also test for line symmetry by placing a mirror along the assumed line and checking whether the half figure and its image are identical to the original figure.



Have students check common designs, logos, and trademarks like the following for line symmetry. Do all these figures have symmetry of line?

1.

2.

3.

4.

The International Harvester logo is reproduced by permission of J.I. Case Company, Racine, Wis.

Another interesting variation is to check pictures of people and objects from newspapers and magazines for line symmetry. Use the folding technique and the mirrors to verify individual judgments.

Audience Level: 6th–12th Grade

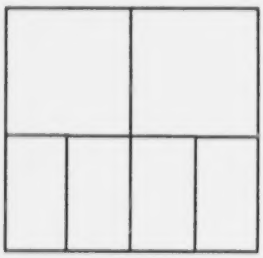
Cognitive Skill: Spatial

Activity: Pattern Recognition

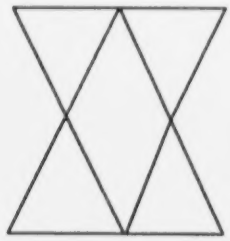
Objective: To identify identical but different-sized forms within a larger figure or shape.

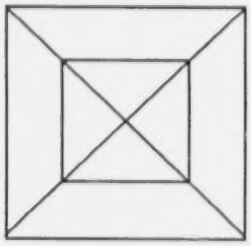
Materials: A copy of this worksheet for each student or an overhead transparency showing the figures.

Procedure: How many *squares* can you find in the shape below?



How many *triangles* can you find in these shapes?





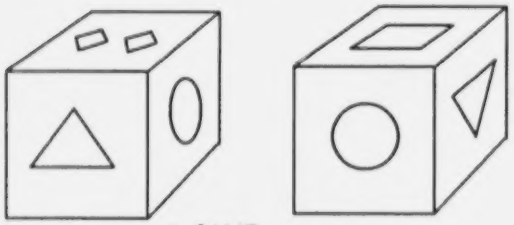
Audience Level: 6th–12th Grade

Cognitive Skill: Spatial

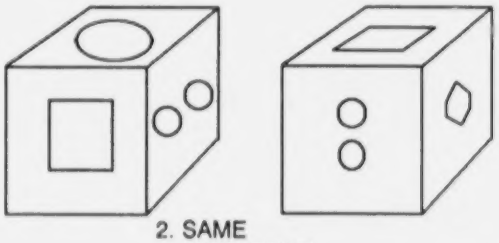
Activity: Cubes

Procedure: All the cubes below have *different symbols* on each of their six sides. Compare each *pair* of cubes to decide whether they are of the same design or different ones. The first pair, for example, are the SAME. If the right cube is flipped so that the triangle is facing you and the circle is on the right, the square would be hidden and the small triangles could appear. The two cubes could be the same. Look at the other pairs and circle your choice of answer.

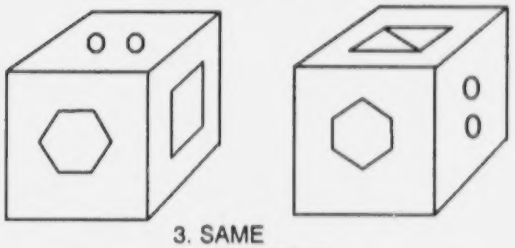
(Adapted from Educational Testing Service Cube Comparison Test.)



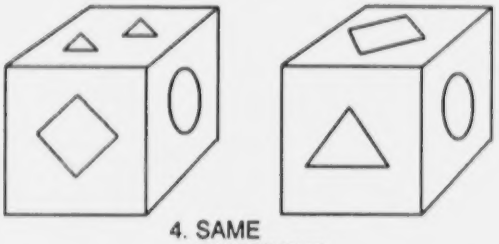
1. SAME
DIFFERENT



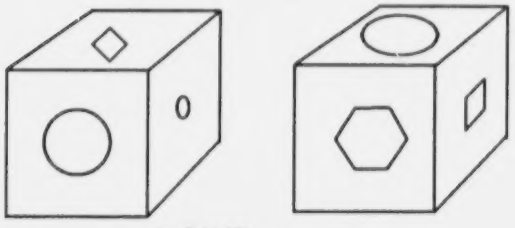
2. SAME
DIFFERENT



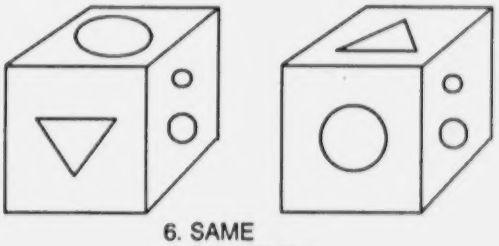
3. SAME
DIFFERENT



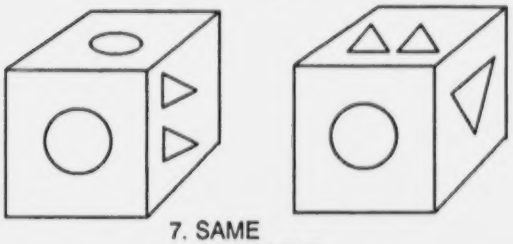
4. SAME
DIFFERENT



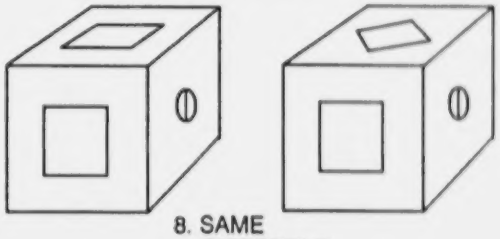
5. SAME
DIFFERENT



6. SAME
DIFFERENT



7. SAME
DIFFERENT



8. SAME
DIFFERENT

Audience Level: 6th–12th Grade

Cognitive Skill: Spatial

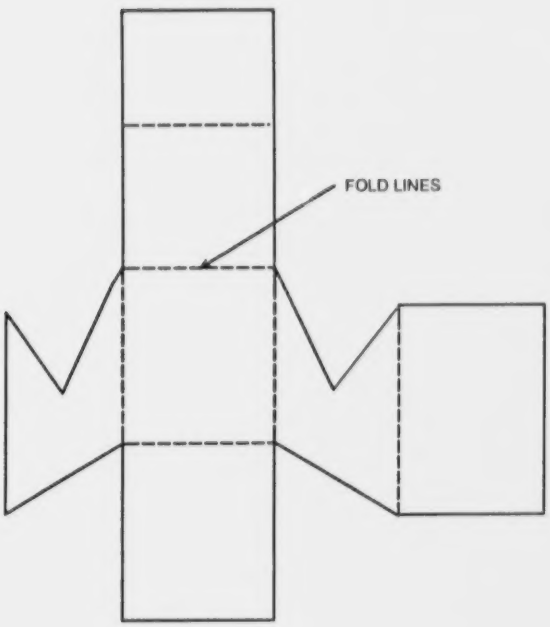
Activity: Pattern Folding-Matching

Objective: To practice imagining how three-dimensional geometric shapes look when unfolded.

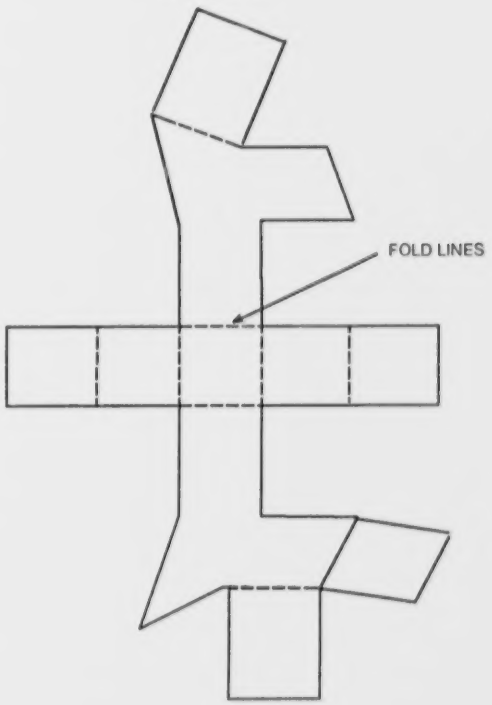
Materials: *Assembled* model patterns 1 and 2.
A copy of the shape choices for each student or pair of students.

Procedure: Cut out and *assemble* both geometric two-dimensional models. Have students describe model 1 (how many sides, what shapes can be identified). Distribute the shape choice sheet (next page) and have each student or pair of students predict how model 1 will look unfolded. When the predictions have been heard, partially unfold the model and ask the class how their predictions are holding up. After completely unfolding model 1, allow the students to compare the figure with the completed shapes on the choice sheet. Repeat the procedure for model 2.

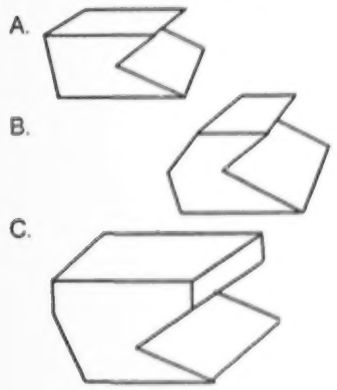
MODEL 1



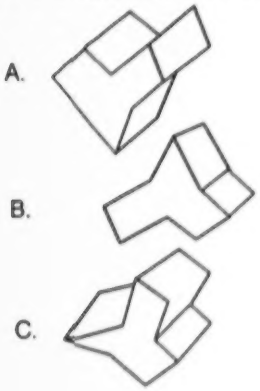
MODEL 2



SHAPE CHOICES FOR MODEL 1



SHAPE CHOICES FOR MODEL 2



Audience Level: 6th–12th Grade

Cognitive Skill: Spatial

Many classroom activities and assignments require students to use spatial skills. When presenting a concept, reinforce analytic skills by demonstrating a step-by-step approach and then emphasize spatial skills by using visuospatial activities.

Content Suggestions:

Math

1. Geometric problems and figures
2. Reading, plotting, and interpreting graphic relationships

Social Studies

1. Map reading
2. Planning a model community by arranging the buildings and roads.

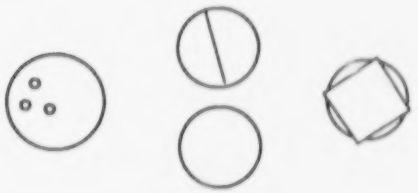
DISCRIMINATION SKILL

Definition: To visualize the important elements of a task; to focus attention on required detail and avoid distractions. (From *Learning Style Profile Examiner's Manual*, p. 5) Discrimination skill is the cognitive process of attention in action. Strength in this skill means that the student attends to the important components of a task and rejects distractors or irrelevant components. Discrimination involves being able to discern what is important, and to focus on that aspect of the task. When new information is presented, students with strong discrimination skills are able to focus on the critical information and to filter the relevant from the less relevant details.

Sample Items from the LSP

In the illustration below is a *sample* circle. Compare the SIZE of the *sample* with the SIZE of each of the other circles around it. Do not measure the circles. Mark either *A*, *B*, or *C* on your answer sheet for each circle:

A. if the circle is *smaller* than the *sample*
B. if the circle is *larger* than the *sample*
C. if the circle is the *same size* as the *sample*



SAMPLE

Research Base

The original research on discrimination referred to the skill as focusing (Schlesinger, 1954). Schlesinger saw focusing as involving two elements: a tendency to narrow awareness, and a tendency to separate emotion from the idea. In the latter domain, he found focusers to be more attuned to the objective than the subjective features of a situation.

This earlier definition of discrimination was reinterpreted by Gardner et al. (1959) to describe focusers as individuals who deploy attention and scan many aspects of experience rather than only a few. The good focuser is a person who discriminates by virtue of having more information from which to make a judgment. Attention can be more narrowly directed on this broader database. The focuser/discriminator constantly scans the environment and is more aware; the nonfocuser is more rigid in what he/she sees.

Narrowness of view was described by Piaget, Vinh-Bang, and Mantalon (1958) as the cause of both under- and overestimation of the size of certain objects. Errors in estimation of size are less likely to occur in those individuals who scan a situation before focusing their attention.

Introduction of Discrimination to Students: Describe this skill as an important one for determining relevant information. The skill involves attending to important elements and ignoring distracting information.

When introducing discrimination, begin with a verbal and written definition of the skill.

> **Discrimination**—to focus your attention on important information while ignoring distractions.

Identify distractions in the classroom such as air conditioners, hallway noises, someone tapping a pencil, thoughts about lunch, etc. There are many environmental distractions and also distractors that appear on every page of written work. When a student is asked to do a page of math problems, he or she must focus on the different numbers and the operations required to compute the problem. Even this variety of stimuli can constitute a distraction.

The following activities will provide direct practice in discrimination skill. The content examples show how discrimination is a necessary part of every lesson.

Audience Level: 6th–12th Grade

Cognitive Skill: Discrimination

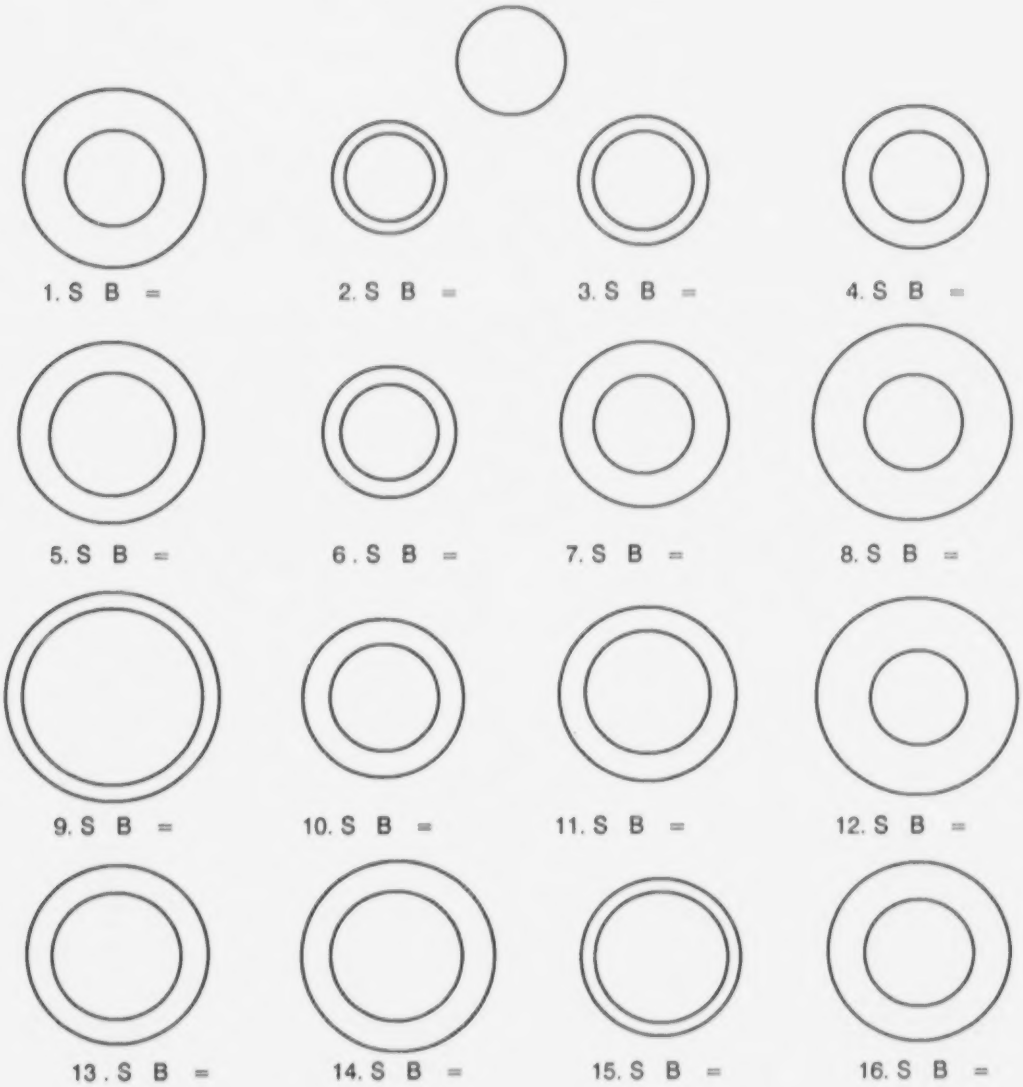
Practice Activity: Visual Attention

Objective: To focus attention on small differences in size.

Materials: This worksheet for each student.

Procedure: Compare the size of the *inside* circle in each of the figures below with the standard. Circle S for smaller, B for bigger, or = for the same.

THIS IS THE STANDARD



Audience Level: 6th–12th Grade

Cognitive Skill: Discrimination

Practice Activity: Scanning

Objective: To locate specific information and to ignore distractions.

Materials: One copy of the scanning worksheet for every student.

Procedure: Have each student examine the scanning worksheet and note the nonsense paragraphs. Instruct students to use a systematic scanning motion (left to right, top to bottom) and mark only the designated letter.

Trial One

Time the students for 30 seconds and instruct them to mark only the letter _____ (select any letter). After 30 seconds, have the students count the number of letters they marked correctly and note any incorrectly marked letters.

Trial Two

Repeat the procedure using a different letter. Poll the class to determine if scores improved. You may want to examine any differences that arise because of particular letters that you selected. For example, lowercase letter "s" may be easier to locate than "p" or "g."

Trial Three

On the third day, try scanning for two letters. Ask if it was more difficult to focus on the additional information.

SCANNING SKILL

Score: _____ correct
_____ incorrect

TRIAL ONE: SCAN FOR LETTER_____.

iensj aldji kjana dhsdis a skusjskja mcieow aias sludfe uiso jo asdywa. ayrwohkj dka xmnkah dk kzilkev vj akur dfjrilmch astpv gjtu thoe. djdkdi wyr ituzx, whyt eteoqk fhfj, rtghuf, eieo, itug. oqwlo bkvfhty khju 1hip wpolk fjgueowk fhd kguwdgf gungu vk. figghph ghqwb eru dgue skuf sksdiu sudf fuq a ufde, sdytfe fyiw fhkmn. eiursn skuse zhs hsufy 1fuory syho jghiri gjvnlsu qysd hs skddg siwy dhseukh jdgh ahsy dhdye hdfy fjfu fsmvcnv dhds euieh skfie sjh cmnv aiakl iaug uka cksfnakvk vnkfd.

Score: _____ correct
_____ incorrect

TRIAL TWO: SCAN FOR LETTER _____.

sdfd dhvk ksdlugf kosf sofi sdois jfoi djhk svsf fh skdy jdysh dksu jdwod vjlmsfoeu zjy siyu ls jsojso fjido akj sfu jsdof jgi fjr sjiof pide fie dj fieii idjfkss skf seui df sfie ahg soidf dkowm t jgi jrio odla skseof gri sjdf, fjod, dshfws ehufi. efy swefusjfy hdf sseflkt. sdf vbn jpy ghkuj guh gjhb ruyfkaf sjghs sg sskf ui rjgj df aiuqi 1khf. sifue kcjg akj laks hse eruyoq ojfho jkj oieur sjdhf au ofd aoy aouy jzjlf al fholnc vhshvc sdjs ieru hfi shkvc gfd tytw iug ln khtuqd qewy ruridg dheu to.

Score: _____ correct
_____ incorrect

TRIAL THREE: SCAN FOR LETTERS
_____ & _____.

jdsh rey owiekj fjgpwl susnch eiowh ywtgrvf ekihfg quye toi dfjh sjn dljjkop priop jodk kbjklk eouj kfjk qj quye iuy, otj, eruy, jri. erbqjfho jfunf re ytrytu rewi oiu jh gfgygn rexrd bnv rexcsdaWq pokjgf hdgdv mnb qoqeiy bvcn fhdj wuwy oxjf yfhfe fjhwxbvc jwjs oklq jsoqi tlkil jpyg nmwu wadlb fkl fhei lokchp skhn sdiduf soiufl lkn slie owieu kljs fop eoiw qpoisp powijfk kjfk mvcn quyw eyo ceiu fjk osaiu lskjp ajp asdwopok vlkj spoief ire.

Audience Level: 6th–12th Grade

Cognitive Skill: Discrimination

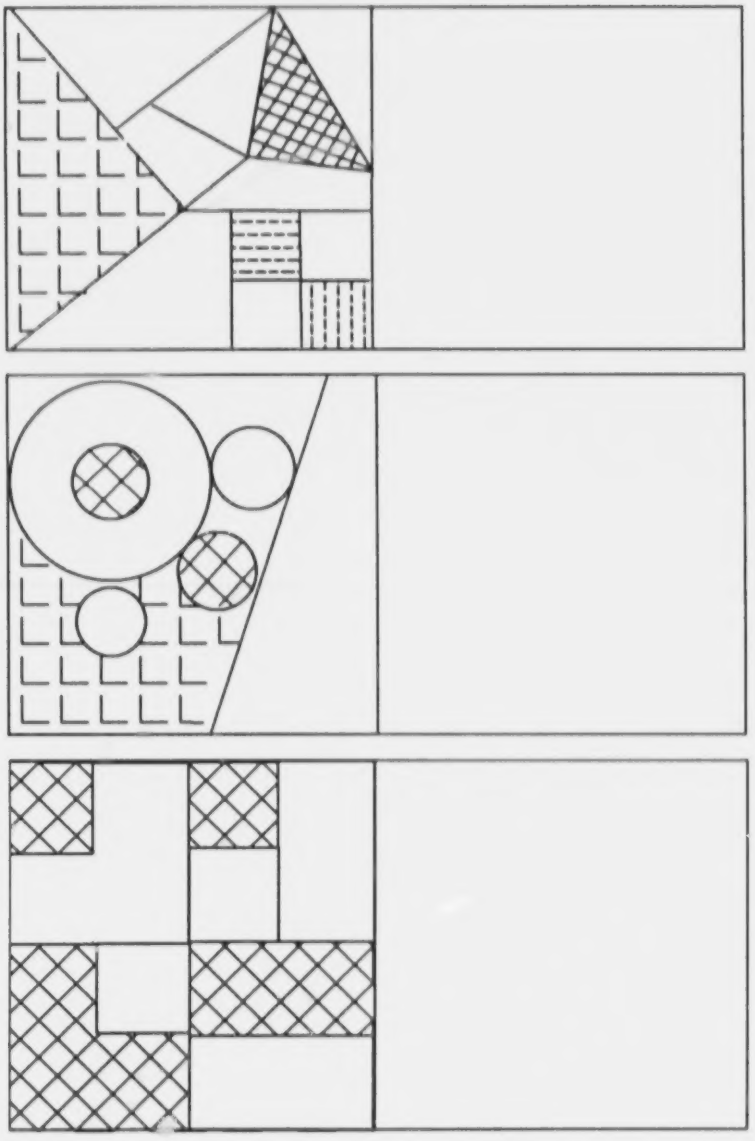
Practice Activity: Focus and Draw

Objective: To focus attention on the details of a design and to accurately reproduce that design.

Materials: One copy of the *Focus and Draw* worksheet for every student.

Procedure: Instruct the students to carefully examine each of the designs. Begin with the first design and systematically break down the picture into parts by looking at the upper left hand corner of the design and moving across the page. Copy the design step by step, one section at a time. You may want to vary the assignment by having the students draw the mirror image of the design.

FOCUS AND DRAW



Audience Level: 6th–12th Grade

Cognitive Skill: Discrimination

Transfer Activity: Hidden Words

Objective: To locate words hidden in the grid and to ignore irrelevant information.

Procedure: Encourage students to scan the grid below from the top left to the bottom right. Look for the first letter of each word. When a letter is found, examine all alternatives around the letter, proceeding clockwise until (including diagonals) the possibilities are matched or eliminated. The exercise encourages careful attention and systematic procedures in the processing of information. It requires no sophisticated reading or comprehension skills.

C	D	B	E	Y	E	S	A	X	W	I	S	H	V
U	V	O	I	C	E	T	H	F	A	T	H	E	R
T	M	C	A	M	E	I	A	L	F	X	S	L	W
K	E	E	P	O	G	L	R	H	A	P	H	E	O
T	R	U	E	A	R	L	D	F	C	L	O	F	O
B	T	O	L	D	O	G	F	C	E	A	W	T	D
U	N	T	I	L	W	R	O	C	K	C	X	Y	S
A	A	G	A	I	N	D	E	A	C	E	D	F	G
C	R	O	S	S	C	B	I	R	D	F	A	L	L

CAN YOU FIND—

1. VOICE	2. FACE	3. CAME	4. ROCK
5. HARD	6. UNTIL	7. KEEP	8. BIRD
9. TRUE	10. SHOW	11. CROSS	12. LEFT
13. CAT	14. TOLD	15. PLACE	16. STOP
17. EYE	18. STILL	19. WOODS	20. GROW
21. WISH	22. FATHER	23. AGAIN	24. FALL

Audience Level: 6th–12th Grade

Cognitive Skill: Discrimination

Transfer Activity: Hidden Numbers

Objective: To locate specific numbers hidden in the grid.

Procedure: Ask students to scan the grid from *right to left*, beginning at the top right and scanning across each row. (Some numbers are listed right to left.) Look for the first digit in the number and scan clockwise around it until the possibilities are matched or eliminated.

6	1	3	7	2	6	5	9	2	7	8	5	2	7	3	8	4
8	4	7	2	5	8	1	6	5	9	6	8	6	5	4	1	6
3	9	4	1	3	2	6	5	2	8	4	3	1	9	7	2	4
7	5	6	2	8	7	9	3	1	7	9	8	3	4	5	1	3
4	1	9	6	2	1	8	4	9	6	3	2	7	1	7	2	8
2	5	6	4	9	1	6	2	4	2	7	5	3	9	3	8	1
6	8	4	5	2	7	4	3	7	9	1	8	4	3	7	2	9
2	9	7	9	3	1	9	4	1	8	5	3	6	4	8	3	1
3	5	1	3	8	5	7	5	2	6	1	7	1	9	3	8	5
6	9	6	2	4	7	8	9	1	5	4	5	6	2	9	8	4
4	8	3	5	6	2	6	1	7	4	3	1	4	7	6	3	9
2	9	1	8	9	7	6	5	9	4	5	7	8	3	5	1	2

A. Can you find:

1. 6439	4. 6741	7. 7943
2. 7573	5. 5384	8. 7469
3. 5628	6. 9576	9. 4456
		10. 6242

B. Can you find six (6) consecutive numbers that add up to 14?— in a straight line or a diagonal.

Audience Level: High School

Cognitive Skill: Discrimination

Transfer Activity: Hidden Meanings

Objective: To identify words with certain meanings and to locate them in the grid.

Procedure: Students should first think of the more obvious words that match the definitions below. Scan the grid from the top left to the bottom right. Look for the first letter of the word you think has the hidden meaning. When a first letter is found, examine in all directions around the letter, proceeding clockwise until the possibilities are matched or eliminated. (This exercise requires some vocabulary skills.)

C	A	O	Y	T	D	R	A	G	H	M	Q	U	I	E	T	E
N	E	C	H	O	O	P	Q	R	I	N	S	T	E	A	D	N
Z	B	N	Y	A	C	O	E	H	E	V	B	E	D	M	E	L
E	A	U	T	N	T	M	P	A	J	I	E	F	E	A	R	D
R	H	N	R	E	O	B	R	N	O	S	C	R	X	T	B	N
O	A	D	A	V	R	L	Q	S	U	I	A	O	I	C	O	J
R	P	E	E	R	I	M	R	W	R	T	O	N	V	H	F	N
T	P	R	O	M	A	J	B	E	N	E	A	T	H	B	T	K
D	E	Q	B	V	Z	E	U	R	E	Z	P	E	D	O	E	P
K	N	I	F	E	M	H	Y	X	Y	W	N	C	P	O	N	Y

Can you find words that mean:

1. response to a question
2. under something
3. to purchase
4. the middle of
5. one who helps you when you are sick
6. to pull along
7. the repetition of a sound
8. be afraid of
9. beginning of the line
10. to make a present of
11. to occur or come about
12. in place of, rather than
13. trip
14. a cutting instrument
15. branch of a tree
16. a thing exactly like another
17. close to
18. many times
19. small horse
20. calm, little noise
21. take away
22. to look at
23. the highest point
24. below something
25. to pay a call upon
26. 12 months
27. nothing

Audience Level: 6th–9th Grade

Cognitive Skill: Discrimination

Content Application: Language Arts: Descriptive Writing

Objective: To focus attention on the details of a setting or character and write a paragraph to vividly describe it.

Materials: Pictures of various settings and characters.

Procedure: Present each student, or small group of students, with a picture of a setting or person. Instruct them to carefully examine the picture and to note as many of the details as possible. Have them write a paragraph to describe the picture. After everyone has finished writing, collect the pictures and paragraphs. Display the pictures in a place visible to the entire class and select one paragraph to read. As you read, have students decide which picture the paragraph describes. Discuss particular words that help communicate the images and the details that communicate a more exact picture to the reader.

Variation: Have the students read a descriptive paragraph and draw a detailed picture of what is described.

Paragraph Example:

Marjorie Kinnan Rawlings

A Mother in Mannville

The orphanage is high in the Carolina mountains. Sometimes in winter the snowdrifts are so deep that the institution is cut off from the village below, from all the world. Fog hides the mountain peaks, the snow swirls down the valleys, and a wind blows so bitterly that the orphanage boys who take the milk twice daily to the baby cottage reach the door with fingers stiff in an agony of numbness.

Reprinted with permission of Charles Scribner's Sons, an imprint of Macmillan Publishing Co., from "A Mother in Mannville" in *When the Whippoorwill* by Marjorie Kinnan Rawlings. Copyright 1940 Marjorie Kinnan Rawlings; copyright © renewed 1968 Norton Baskin.

Audience Level: 6th–8th Grade

Cognitive Skill: Discrimination

Content Application: Social Studies—Reading Charted Information.

Materials: A chart and a question sheet for every student.

Objective: To practice attending to specific information that is contained within a complex listing.

Procedure: Provide each student with the charts on the next page and guide them in breaking down the information. Ask what information is provided on the charts and then begin to look at the specific columns of information. After the students understand the format of the chart, present them with the eight questions that require them to locate discrete information. To practice using discrimination skills the students must attend to specific information and ignore other distracting information. Monitor the students' accuracy and compare answers after everyone has had time to work independently.

Note: Analytic skills are also needed for this exercise.

DISCRIMINATION SKILL: QUESTIONS ABOUT CHARTED INFORMATION

TEMPERATURES: THE NATION

1. What city(s) had temperatures higher than 98 on Friday?
2. On Sunday, what city(s) forecasted a temperature of 51?
3. For today's forecasted temperatures, what city predicts the coolest temperature?
4. What is the temperature high and the low for Omaha on Friday?
5. Describe today's weather in Grand Rapids.

TEMPERATURES: THE WORLD

6. What city(s) outside the United States reported temperatures below 50?
7. Describe the weather in London.
8. What are the temperature lows and highs between Brussels and New Delhi?

TEMPERATURES: The nation

Temperatures on left indicate previous day's high and overnight low. Tomorrow's temperatures and outlook are in the right columns.

Cities	Fri.	Today		Sun.	
Albany, N.Y.	73/46	81/54	m	79/70	cdy
Albuquerque	88/67	91/65	cdy	90/64	cdy
Amarillo	89/65	89/64	cdy	89/64	cdy
Anchorage	62/49	65/48	cdy	67/49	cdy
Asheville	90/63	88/63	cdy	90/64	cdy
Atlanta	99/75	96/74	cdy	97/73	cdy
Atlantic City	69/62	74/59	clr	83/65	cdy
Austin	93/71	94/70	cdy	95/72	cdy
Baltimore	81/63	87/60	clr	89/68	cdy
Billings	99/72	98/66	cdy	100/66	cdy
Birmingham	97/71	96/72	cdy	96/72	cdy
Bismarck	100/68	91/56	clr	93/55	clr
Boise	95/64	100/67	cdy	94/71	cdy
Boston	65/57	77/57	cdy	82/64	m
Brownsville	92/72	92/72	cdy	92/73	cdy
Buffalo	79/47	84/64	m	74/67	cdy
Burlington, Vt.	71/40	79/56	m	76/69	cdy
Casper	102/67	90/61	cdy	91/58	cdy
Charleston, S.C.	88/79	92/75	cdy	94/74	clr
Charleston, W.Va.	91/64	93/65	clr	87/71	cdy
Charlotte, N.C.	89/72	90/70	cdy	95/71	cdy
Cheyenne	95/62	85/60	cdy	83/58	cdy
Chicago	92/63	102/73	clr	78/65	clr
Cincinnati	92/63	97/68	cdy	88/73	cdy
Cleveland	79/53	93/66	cdy	75/67	cdy
Columbia, S.C.	99/73	95/71	cdy	96/70	clr
Columbus, Ohio	88/57	94/66	cdy	83/70	cdy
Concord, N.H.	72/46	75/45	m	76/61	m
Dallas-Ft Worth	98/72	94/74	cdy	95/74	cdy
Dayton	90/56	94/67	cdy	85/72	cdy
Denver	99/64	95/64	cdy	92/64	cdy
Des Moines	102/74	100/76	clr	90/68	clr
Detroit	82/58	91/68	cdy	79/62	clr
Duluth	85/45	78/64	clr	77/51	clr
El Paso	95/72	94/69	cdy	93/69	cdy
Evansville	99/71	100/74	clr	93/76	cdy
Fairbanks	61/54	72/48	cdy	75/50	clr
Fargo	94/66	89/65	clr	90/55	clr
Flagstaff	87/56	84/55	m	82/51	m
Grand Rapids	87/56	92/71	cdy	78/61	clr
Great Falls	89/66	95/55	cdy	92/63	m
Greensboro, N.C.	78/70	88/67	cdy	92/68	cdy
Hartford	75/46	80/51	cdy	82/66	m
Helena	91/65	94/56	m	90/60	m
Honolulu	88/73	88/74	clr	89/74	clr
Houston	83/74	88/73	m	93/73	m
Indianapolis	95/66	98/75	cdy	86/72	cdy
Jackson, Miss.	96/73	94/72	cdy	93/74	cdy
Juneau	58/49	66/46	m	62/48	cdy
Kansas City	103/75	103/75	clr	91/72	clr
Las Vegas	107/80	103/80	clr	102/75	clr
Little Rock	99/76	95/75	cdy	96/75	cdy
Los Angeles	76/59	79/59	clr	82/60	clr
Louisville	97/70	97/76	clr	91/76	clr
Lubbock	96/66	89/66	cdy	89/65	cdy
Memphis	98/77	98/78	cdy	98/79	cdy
Midland-Odessa	93/65	90/67	cdy	89/67	cdy
Milwaukee	91/65	94/74	cdy	70/61	clr
Mpls-St Paul	101/70	87/69	clr	83/62	clr
Nashville	102/75	100/76	cdy	99/77	cdy
New Orleans	100/73	90/75	m	91/75	m
New York City	81/61	83/63	cdy	82/68	cdy
Norfolk, Va.	74/66	84/64	clr	92/70	cdy
North Platte	102/74	96/67	clr	91/63	clr
Oklahoma City	95/74	96/72	clr	99/74	clr
Omaha	101/77	98/74	clr	91/69	clr
Philadelphia	83/60	87/60	clr	89/67	cdy
Phoenix	108/90	108/85	cdy	108/85	cdy
Pittsburgh	87/50	89/61	m	79/67	cdy
Portland, Maine	71/45	65/47	cdy	74/57	m
Portland, Ore.	82/50	83/57	clr	76/59	cdy
Providence	73/53	76/53	cdy	80/63	m
Raleigh	80/71	88/68	cdy	93/69	cdy
Rapid City	106/69	90/66	clr	93/63	clr
Reno	103/62	93/63	m	90/57	clr
Richmond	80/68	89/65	clr	93/70	cdy
Sacramento	103/65	94/65	clr	88/58	clr
St Louis	102/76	103/81	clr	94/77	clr
Salt Lake City	102/69	99/71	clr	96/69	cdy
San Antonio	95/69	95/70	cdy	96/73	cdy
San Diego	71/62	72/62	clr	74/62	clr
San Francisco	67/55	66/55	clr	70/54	cdy
San Juan, P.R.	90/77	91/76	m	90/76	cdy
St Ste Marie	59/49	76/56	cdy	67/47	cdy
Seattle	77/52	83/55	clr	72/55	cdy
Shreveport	93/72	92/73	cdy	93/74	cdy
Sioux Falls	107/75	92/73	clr	90/62	clr
Spokane	83/51	91/54	clr	86/64	cdy
Syracuse	73/45	83/58	m	76/67	cdy
Topeka	100/65	99/70	clr	95/70	clr
Tucson	106/78	105/74	cdy	105/73	cdy
Tulsa	98/74	98/76	clr	99/77	clr
Washington, D.C.	81/67	88/65	clr	91/73	cdy
Wichita	100/68	99/70	clr	97/71	clr
Wilkes-Barre	79/48	82/56	clr	86/68	cdy
Wilmington, Del.	80/58	84/58	clr	87/67	cdy

TEMPERATURES: The world

Temperatures and weather conditions from midnight to midnight on previous day; m indicates missing information.

Amsterdam	59	55	cdy	Lisbon	73	81	cdy
Athens	88	64	cdy	London	66	57	cdy
Auckland	61	46	clr	Madrid	79	59	clr
Bangkok	93	81	clr	Manila	90	77	m
Barbados	89	78	cdy	Mexico City	71	57	m
Beijing	77	68	cdy	Montreal	66	52	cdy
Beirut	82	66	clr	Moscow	79	59	clr
Belgrade	72	61	cdy	Nairobi	73	54	clr
Berlin	63	50	m	Nassau	89	77	cdy
Bogota	64	50	cdy	New Delhi	94	76	cdy
Brussels	70	46	clr	Nicosia	90	64	clr
Budapest	75	57	clr	Oslo	84	66	cdy
B'Aires	64	46	clr	Paris	72	55	m
Cairo	90	70	clr	Rio	m	m	m
Calgary	81	55	cdy	Rome	84	63	cdy
Caracas	82	64	m	San Juan	92	75	cdy
Copenhagen	72	50	clr	Santiago	61	38	clr
Dublin	72	50	clr	Sao Paulo	m	m	m
Frankfurt	68	46	clr	Seoul	84	68	clr
Geneva	75	61	clr	Singapore	86	79	cdy
Harare	73	50	cdy	Stockholm	75	66	clr
Havana	89	76	cdy	Sydney	64	46	clr
Helsinki	66	57	cdy	Taipei	90	79	cdy
Hong Kong	79	77	m	Tel Aviv	81	70	clr
Istanbul	72	59	cdy	Tokyo	73	68	m
Jerusalem	75	57	clr	Toronto	68	55	cdy
Jo'burg	63	32	clr	Vancouver	63	52	cdy
Kiev	72	57	cdy	Vienna	70	58	clr
Lima	65	56	cdy	Warsaw	61	52	cdy

Audience Level: 6th–8th Grade

Cognitive Skill: Discrimination

Content Application: Social Studies—Stock Market

Materials: A pictorial stock market page and a question sheet.

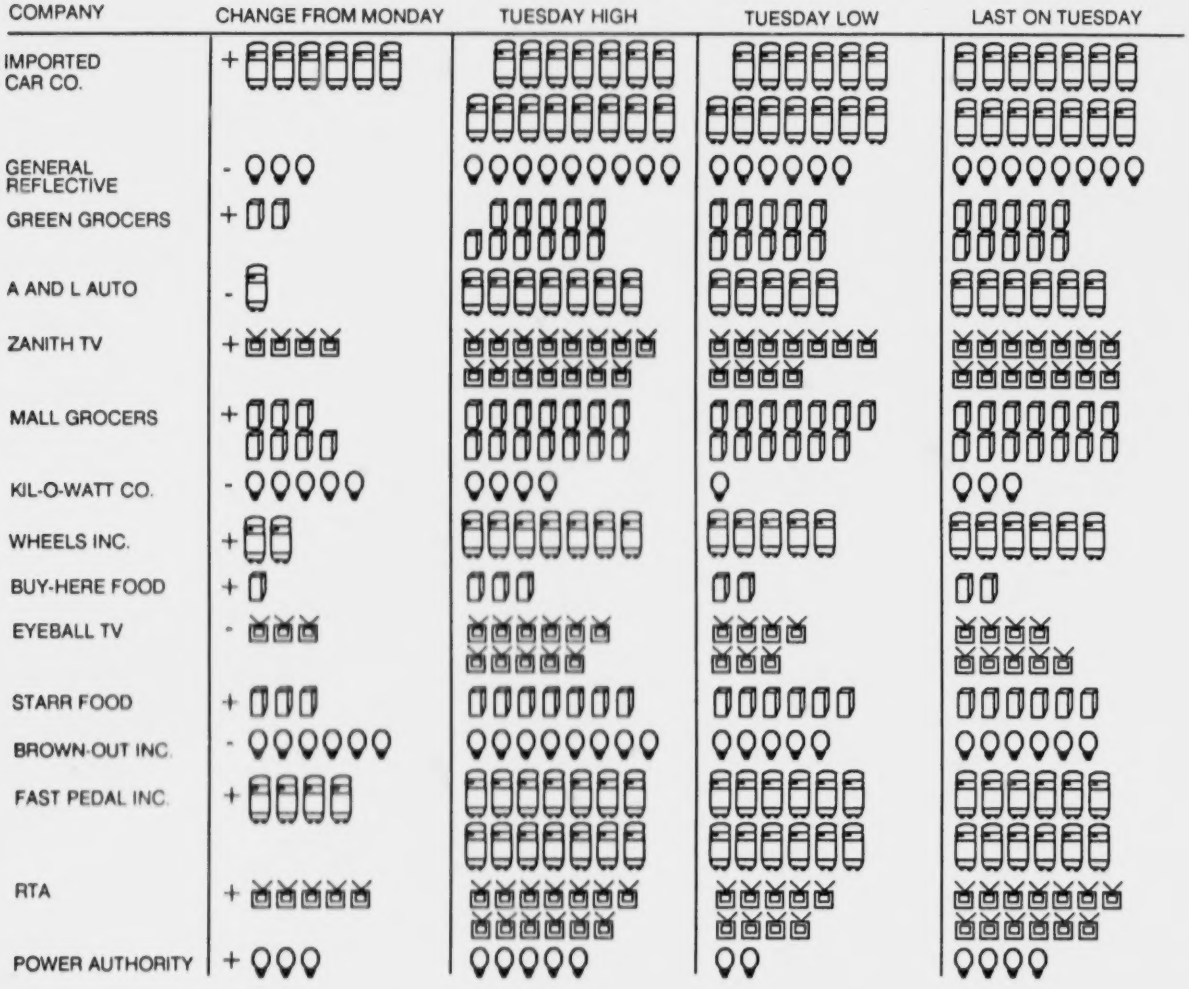
Procedure: Give each student a pictorial stock market report. Ask them to scan the chart to see what information is recorded and in what format. They may work individually, in pairs, or in small groups. After they have become familiar with the chart give them the specific questions at the right. All the information needed to answer the questions is contained in the stock market report.

Questions About the Pictorial Stock Market Report

1. Write the names of all the automobile companies.
2. Write the names of all the television companies.
3. Write the names of all the electric companies.
4. Write the names of all the food companies.
5. Write the names of all the companies that had a positive change from Monday.
6. Write the names of all the companies whose low on Tuesday was below 9.
7. Write the names of all the companies whose low on Tuesday was below 6.
8. Write the names of all the companies whose last on Tuesday was below 6.
9. Write the names of all the companies whose last on Tuesday was the same as the high on Tuesday.
10. Write the names of all the companies whose last on Tuesday was the same as the low on Tuesday.

PICTORIAL STOCK MARKET REPORT

Study this graph from the stock market page of a newspaper.



Audience Level: 6th–12th Grade

Cognitive Skill: Discrimination

Every task requires the use of discrimination skills. During lectures, students must focus on important information auditorily; when given a written task they must focus on the information visually. In either case, many distractions must be ignored to successfully complete the task.

Content Suggestions:

Reading

1. Any reading task that requires the student to look for specific information
2. Pre-reading activities that require the student to preview or scan for information
3. Seek and Find activities

Math

1. Word problems that require the student to attend to the important and relevant data while ignoring descriptive information
2. A series of related problems that requires the student to focus on the operations of each problem and solve them appropriately

Social Studies

1. Reading charts, graphs, and tables
2. Map reading that requires the student to locate specific information

Literature

1. Writing a character sketch that asks the student to give a detailed description of a particular person in a story

CATEGORIZATION SKILL

Definition: To use reasonable versus vague criteria for classifying information; to form accurate, complete, and organized categories of information. (From *Learning Style Profile Examiner's Manual*, p. 5) Categorization is taking new information and placing it in the existing structures of long-term memory or creating new categories when none exist. Narrow categorizers tend to use precise criteria in identifying new information. Precision in defining the characteristics of data makes placement in existing categories more likely. Broad categorizers tend to perceive new information more vaguely and are not always accurate in placing it into existing structures.

Sample Items from the LSP

The following questions give averages for several categories of things. Decide what you think should be the largest and smallest choices for each category and mark them on your answer sheet. (No combination of choices will give you the *true* average so no arithmetic is needed. For each question, just choose the number you think is the most likely.)

The length of the average whale is about *65 feet*. What do you think:

17. is the length of the longest whale?
    A. 120 feet C. 86 feet
    B. 190 feet D. 75 feet
18. is the length of the shortest whale?
    A. 6 feet C. 52 feet
    B. 43 feet D. 21 feet

Research Base

Gardner (1953) observed that all persons are characterized by equivalence range (category width) preferences in a variety of adaptive tasks. They vary widely in the span of objects which they are willing to place under one conceptual heading. Some persons categorize broadly and are comfortable placing a variety of objects in one category. Others are uncomfortable with broadly defined categories and prefer to create categories with few items or a narrower range of qualities. Pettigrew (1958) concluded that a person's tendency toward broad, medium, or narrow categorizing remained consistent over a wide range of tasks.

Studies of categorizing width by Bruner and Rodrigues (1956) showed a general tendency toward coarseness or fineness in categorizing. Their findings offered further support to the conclusion that individuals are characterized by consistent differences in equivalence range in a wide variety of situations.

The basic difference between narrow and broad categorizers seems less a matter of sensitivity to differences in objects and ideas than in the degree to which individuals feel impelled to act on or to ignore awareness of the differences. Broad categorizers tend to focus on the obvious. Narrow categorizers use salient details to form a larger number of categories.

When categories are more tightly defined, they are more accessible for future learning and problem solving. New information is judged in terms of clear parameters, matching the new with the existent. Letteri (1985) found that narrow categorizers do better in school because they are able to identify new information with enough precision to place it accurately into the network of categories of long-term memory. Information that is placed more accurately in long-term memory can more easily be recalled when it is needed.

Introduction of Categorization Skill to Students: Explain to the students that, when you place information in related groups or categories, you are "filing" the information in the brain. If you use general titles for the files, the information may be lost because it is grouped together with other similar information. If you separate the information by giving it a specific title, the information will remain neat and distinct. When you need to recall specific information, you can more easily find it because it has been stored in a specific category.

After this simplified explanation of the importance of the skill, give students a verbal and written definition of the skill.

Categorization—to form accurate, complete, and specific groups of related information.

The following practice activities emphasize the use of categorization generically. The content examples demonstrate how categorization skills are used in most classroom activities.

Audience Level: 6th–9th Grade

Cognitive Skill: Categorization

Practice Activity: Differences

Objective: To judge the differences and the relationships among similar concepts, based on some standard.

Procedure: Give students a copy of this sheet or write the sets of alternatives below on the blackboard or a transparency. Have students number the alternatives in the order of the least to the most differences from the standard. Number each list in order by writing the numerals 1, 2, 3, 4, 5 in front of the words.

1. From *hot* to *cold*
   _____ sunshine
   _____ ice cube
   _____ water
   _____ chilly
   _____ flame

2. From *big* to *little*
   _____ gorilla
   _____ bee
   _____ boy
   _____ skyscraper
   _____ dog

3. From *slow* to *fast*
   _____ moving car
   _____ turtle
   _____ rabbit
   _____ fish
   _____ glacier

4. From *young* to *old*
   _____ grandmother
   _____ colt
   _____ fossil
   _____ bird
   _____ infant

Audience Level: 6th–9th Grade

Cognitive Skill: Categorization

Practice Activity: Alphabetizing

Objective: To create simple but practical categories for relating information.

Procedure: Give students a copy of this sheet and ask them to write down the alphabet:

1. Write the words below in alphabetical order.

kind	hen	take	fork
put	wool	big	play
good	new	step	again

2. Number the following words in alphabetical order. Watch the first three letters at the beginning of each word as you alphabetize.

List 1	*List 2*	*List 3*
__ anxious	__ exercise	__ probably
__ ancestors	__ expected	__ price
__ broader	__ figure	__ pressed
__ breeze	__ failed	__ refuse
__ brushed	__ filtered	__ remaining
__ brilliant	__ furniture	__ recognized
__ choice	__ fawn	__ restocked
__ collie	__ faucets	__ realized
__ charged	__ future	__ shy
__ coal	__ fuse	__ shocks

Audience Level: 6th–12th Grade

Cognitive Skill: Categorization

Practice Activity: Category Challenge

Objective: To practice creating specific and accurate categories.

Materials: A word bank for each student and multiple wordcard blanks.

Procedure: Instruct the students to pick from the word bank any three words that can be grouped together to form a category. List the three words on a category card and write a title for the group.

Everyone should develop four to ten category cards. It is important to stress that each student work independently, because all cards will be used for the game.

When the cards are completed, have everyone form a large circle. (If there are more than 20 students, form two circles.) The first person should pick one card and read only the three words listed for the category. The words should be read out loud and directed to the person on the immediate right. After listening to the three words, if that person can accurately name the category, he or she earns a point. If that person cannot name the category, the person reading the words earns a point. The challenger may request "a more specific title." For example, if the three words are June, July, and August, the player might say "months of the year" (which is accurate), but the challenger might request "a more specific title." The player might then say "summer months." Next, the player picks a category card and reads the three words to the person on his/her right. The activity proceeds around the circle in this manner.

CATEGORIZATION SKILL: WORD BANK

bulletin	rain	July
athletic	broom	mop
apple	fish	thunder
nickel	bicycle	map
Hawaii	periwinkle	Puerto Rico
principal	median	lily
eel	lake	glass
sponge	August	sign
June	Sheriff	steel
vacuum	Philippines	ramp
fog	pamphlet	car
mug	strawberry	violet
hail	book	iron
dime	snow	

CATEGORY TITLE	CATEGORY TITLE
CATEGORY TITLE	CATEGORY TITLE
CATEGORY TITLE	CATEGORY TITLE

Audience Level: 6th–9th Grade

Cognitive Skill: Categorization

Content Application: English/Language Arts

Objective: To review the parts of speech by forming accurate categories.

Materials: A word list and a category chart for each student (see pages 31 and 32).

Procedure: Instruct students to cut out all the word cards and arrange them on the category chart. Seven of the word cards should be used as category titles. There are seven blank cards to be used to add one original word to each category.

CATEGORIZATION SKILL: WORD LIST

nouns	violent	mysterious	prepositions
They	behind	tiny	red
pigeon	tripped	off	t-shirt
interjections	slogan	Alice	and
onto	listen	verbs	overslept
but	you	wow	over
yeah	ugh	flipped	pronouns
adjectives	their	alley	skidded
scarf	I	throughout	prowl
or	coach	rush	he
she	swerved	conjunctions	oh

CATEGORIZATION SKILL: CATEGORY CHART

CATEGORY TITLE	CATEGORY TITLE	CATEGORY TITLE	CATEGORY TITLE	CATEGORY TITLE

Audience Level: Senior High School

Cognitive Skill: Categorization

Activity: Creating Categories

Objective: To formulate accurate categories for categorizing concepts.

Materials: A copy of this worksheet for each student.

Procedure: Read the following lists of words and group the words for each list in at least *five* categories. The key to the activity is carefully choosing the concepts that form the categories.

LIST 1	*LIST 2*	*LIST 3*	*LIST 4*
Analyzing	Astronomy	Botany	Acting
Biology	Cycle	Chemistry	Aerospace
Cause-Effect	Designing	Essay	Energy
Change	Drama	Identifying	Observing
Classifying	Hypothesizing	Inferring	Oceanography
Defining	Measuring	Interpreting	Physics
Evolution	Meterology	Matter	Predicting
Geology	Novel	Non-fiction	Questioning
Poetry	Organism	Relativity	Researching
Psychology	Physiology	Spelling	Short Story
Reading	Population	System	Space-Time
Speaking	Writing	Zoology	Universe

Audience Level: 6th–12th Grade

Cognitive Skill: Categorization

Grouping information by specific characteristics helps students store the information in an organized way for more efficient retrieval.

Content Suggestions:

Science

Observations or charts that require grouping data; for example: the subgroups of the periodic table of chemical elements

Literature

Comparing story characters, settings, plots, etc., by listing the distinctive features and grouping the information to draw comparisons

Math

Grouping shapes by well-defined characteristics; for example: circles, squares, triangles, cylinders, pyramids, etc.

Social Studies

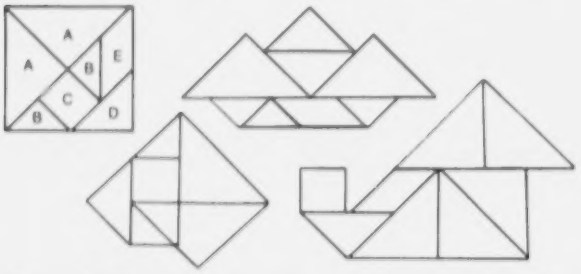
Grouping ideas or organizations by similarity of opinion or ideology; for example: Liberal, Conservative; Communist, non-communist; realist, idealist, etc.

SEQUENTIAL PROCESSING SKILL

Definition: To process information sequentially and verbally; to readily derive meaning from information presented sequentially or verbally. (From *Learning Style Profile Examiner's Manual*, p. 5) Often labeled successive processing, this skill is one of two modes of information processing available to all individuals. Along with simultaneous processing, strength in this skill is related to an individual's habitual mode of processing information and the nature of a given task. Sequential or successive processing refers to processing information in serial or temporal order. Individuals strong in this skill favor the processing of information in a step-by-step, linear fashion.

Sample Item from the LSP

Look at the *sample* puzzle below. The shapes used in this sample are marked A, B, C, D, and E. Some of the shapes are not used in the other puzzles on this page. Only one shape is missing from each puzzle. Mark the letter of the missing shape on your answer sheet.



Research Base

Sequential or successive processing is based on the work of the Russian psychologist Alexander Luria (1973). He proposed that the brain was composed of three functional units or blocks, each with a structural component of three levels. According to Luria, each block had a specific function to perform and was related to the other blocks. Block two is located in the occipital, parietal, and temporal lobes of the right and left hemisphere. It was in this block that information was processed in two qualitatively different ways, simultaneous and successive. Strength in both modes of processing was deemed crucial to successful performance, and each was required in different degrees to perform all tasks.

Various studies indicate that school achievement is related to both simultaneous and successive processing (Das, 1973; Sprecht, 1976). Krywaniuk (1974) found that high achieving third graders were superior to low achieving third graders in all the tests of simultaneous-successive processing. Das, Manos, and Kanungo (1975) discovered that lower socioeconomic children demonstrated a preference for the successive mode. These findings may well relate to the deprivations in background and experience more likely to be found in poor children. They are less likely to have developed the rich cognitive structures to which many visual experiences can be linked. Kirby and Das (1977) concluded that neither one of the information-processing dimensions was more or less important to school achievement. High achievement in school was related to high levels of ability in each mode of processing information.

Introduction to Sequential Processing: When we process information using a sequential processing mode, we use analysis and step-by-step procedures. Traditionally, schools have emphasized the sequential processing mode. For example, we use grade levels to show progress in a linear fashion; we follow a rigid daily schedule of classes; we sit in desks that are usually aligned in rows facing in one direction; and we pursue our curricula in lockstep fashion.

In learning to read, most of us started by sounding out the words and breaking them into individual letter sounds so that we could pronounce the word. By breaking them down into smaller parts, we were able to sound out the smaller parts and then combine them. This process is sequential. In learning to do arithmetic, we divide, multiply, add, and subtract by following a series of specific procedures. As we progress to higher mathematics, we learn to solve equations by working systematically from the inside out. Both these processes involve using a sequential approach.

At this point, ask the students to identify other activities that are done in a sequential fashion (e.g., language learning, scientific experiments, etc.)

The activities described in the analytic skill section support sequential processing. When you approach an activity analytically, you break the task into its parts to better understand the whole. When you process sequentially, you place these parts in order for better understanding. The flowcharting activity described in the analytic skill section uses both analysis and sequential processing. In writing down all the steps of a particular task, we are using analysis. By ordering those steps in a linear pattern, we are processing the information sequentially. Many activities in school and in life require sequential processing. Strength in sequential processing is important to success.

Audience Level: 9th–12th Grade

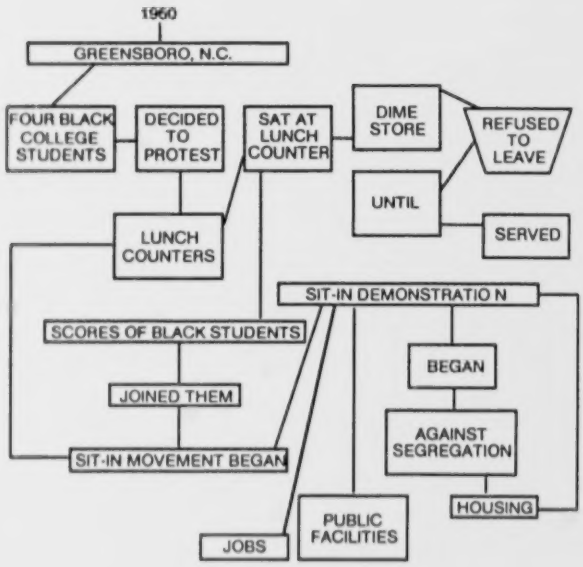
Cognitive Skill: Sequential Processing

Content Application: Social Studies or Language Arts

This activitiy may be done by students alone, in pairs, or in small groups. Assign students to read a passage from the text or from another source of information that you provide. (You can also use a videotape, audiotape, film, etc.) Ask the students to read the material and link the major ideas and concepts together by lines using an approach sometimes called webbing or cognitive networking. An example follows:

Reading: In 1960 in Greensboro, North Carolina, four black college students decided to protest the custom of providing standing-room-only for blacks at lunch counters. They sat down at the lunch counter of a dime store and refused to leave until they were served. Scores of black students joined them. Thus, the sit-in movement began.

Sit-in demonstrations against segregation and discrimination in public facilities, jobs, and housing spread rapidly throughout the South and then across the nation.



(Other examples of webbing or similar exercises can be found in Mary Frances Claggett's monograph *Balancing the Hemispheres: Brain Research and the Teaching of Writing* and in Peter Russell's *The Brain Book*.)

Audience Level: 6th–8th Grade

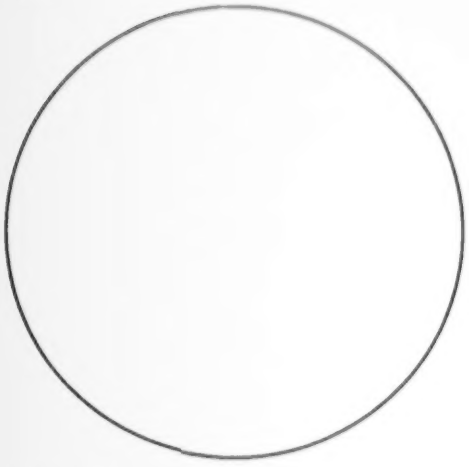
Cognitive Skill: Sequential Processing

Content Application: Geometry–Area of a Circle (A)

Objective: To find the area of a circle by following the steps of the algorithm. This activity was provided by Mrs. Cindy King, middle school mathematics teacher, P. K. Yonge Laboratory School. (This kind of activity also requires analytic and discrimination skills.)

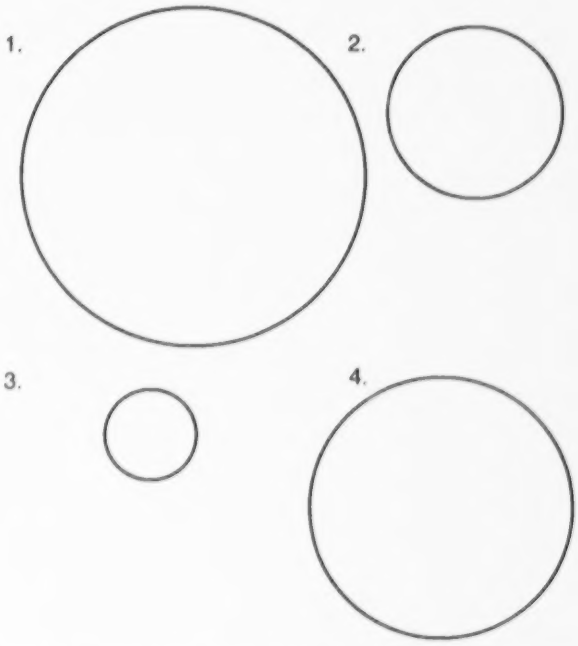
Procedure:
1. Measure the diameter of a circle.
2. Divide the diameter in half to find the radius
3. Square the radius.
4. Multiply by π.
5. Now you have the area ($A = \pi r^2$)

Example:



1. $d = 6.7$ cm
2. $d/2 = r = 3.35$ cm
3. $(3.35)2 = 11.22$ cm
4. $r^2 \times \pi = 11.22 \times 3.14$
5. $A = \pi r^2 = 35.23$ cm^2

Find the areas of the circles below using the steps in the procedure above.

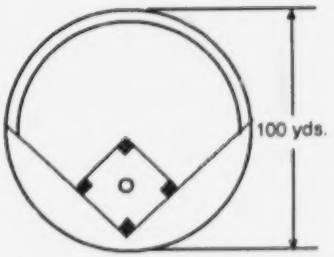


For additional practice in the activity, use the Cognitive Skill Information Sheet, "Area of Circles," on the following pages.

COGNITIVE SKILL ACTIVITY SHEET:
SEQUENTIAL PROCESSING

Area of circles (B)

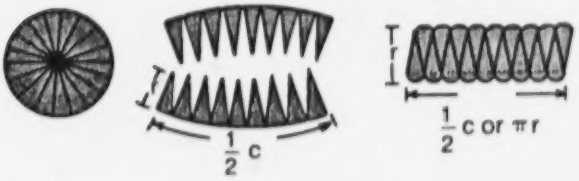
A baseball club wants to cover its circular field with artificial turf. How much turf should they order? To answer this question you will need to find a formula for the area of a circle.



1. What is the circumference of the field?

   _____ yards

   A model of the field can be cut into pie-shaped pieces. These pieces can be rearranged to form a figure that is almost a parallelogram.



The area of a parallelogram is the base times the height. $A = b \cdot h$

In this "parallelogram," the base is ½ the circumference of the circle, and the height is the radius of the circle. $A = \frac{1}{2} c \cdot r$

$A = \pi r \cdot r$

$A = \pi r^2$

2. Why is the area of the "parallelogram" equal to the area of the circle?

3. Find the amount of turf needed to cover the field.

   Radius = ____ yards Area = _____ square yards.

This lesson was excerpted from the text, *Applications in Mathematics, Course A*, by D. Johnson, V. Hansen, W. Peterson, J. Rudnick, R. Cleveland, and A. Bolsteer, Scott Foresman & Co, 1972. Reprinted by permission of Scott, Foresman & Co.

Find the area of each circle below.

4. Area = _____ sq. ft 5. Area = _____ sq. in 6. Area = _____ sq. ft

7. Radius = _____ ft 8. Radius = _____ ft 9. Radius = _____ in
   Area = _____ sq. ft Area = _____ sq. ft Area = _____ sq. in

10. Would you get more pizza if you bought two 8-inch pizzas or one 16-inch pizza? Complete table 2.

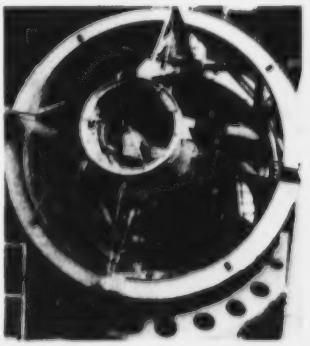
Table 2

Pizza	Radius	Area
8-inch		
16-inch		

11. If you double the radius of a circle, is the area doubled? _____

12. Should a 16-inch pizza cost twice as much as an 8-inch pizza? _____

13. The world's largest reflecting telescope is Hale Observatory on Palomar Mountain, California. Find the circumference and area of the lens. Its diameter is 200 inches.



Circumference = _____ inches

Area = _____ square inches

Audience Level: 6th–12th Grade

Cognitive Skill: Sequential Processing

Content Application: Various

Any time you use a classroom activity in which students are asked to follow a step-by-step procedure, you are asking them to apply sequential processing skill. The following list of activities includes examples of sequential processing in a variety of content areas.

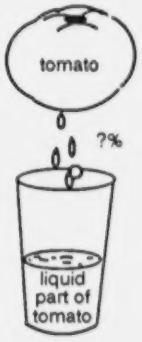
1. Completing an experiment in a *science* class by following a step-by-step process.

   For example:
   Chemistry–Finding the percentage of water in a tomato. (See the next page.)
2. Preparing food in a *home economics* class by following a recipe.
3. Constructing a project in *industrial arts, metals, or graphics* by following directions that are spelled out in a step-by-step fashion. Students apply the steps in the order given.
4. In *photography*, developing film by following specific directions in the proper order.
5. In *physical education*, practicing a skill or doing an aerobic exercise in accordance with a specific step-by-step procedure.

ACTIVITY SHEET: SEQUENTIAL PROCESSING
THE PERCENT OF WATER IN A TOMATO

Pre-Lab Discussion

Percent tells the ratio of each part of something to 100 of the whole thing. For example, to say that 15% of a piece of meat is fat means that there are 15 grams of fat (the part) for every 100 grams of meat (the whole).



In order to calculate a percent, the quantities of both the part and the whole must be measured in the same units. To perform the actual calculation, the quantity of the part is divided by the whole quantity and the result multiplied by 100%. For example, if a 200-gram piece of meat contains 30 grams of fat, then 15% of the meat is fat:

$$\frac{\text{30 grams fat}}{\text{200 grams meat (including fat)}} \times 100\% = 15\%$$

Percent is important to chemists in a number of ways, but especially as a means of providing information about chemical compounds. Chemical compounds are substances composed of two or more elements. The *chemical composition* of a compound tells the percentage by mass of each element in the compound. For example, water is composed of the elements hydrogen and oxygen. The chemical composition of water is 11% hydrogen and 89% oxygen. This means that every 100-gram sample of water is composed of 11 grams of hydrogen and 89 grams of oxygen.

In this experiment, we will work with percents but will do so using a familiar object—a tomato.

Purpose

Find the percent of water in a tomato.

Materials and Equipment

- Tomato
- Strainer and spoon, or food mill, or blender
- Beaker, 400-ml
- Funnel
- Filter paper
- Laboratory balance
- Aluminum foil (for a surface upon which to spread out the mashed tomato while it is drying)
- Safety glasses or goggles

Safety

Observe good lab safety practices. Do not eat or drink any part of your tomato. Foods that are handled in a chemical laboratory can easily become accidentally contaminated with chemicals.

Procedure

1. Read the entire remainder of this lab before carrying out the next step of this procedure.
2. Prepare a written plan of action that describes the way you plan to proceed with the work. *Get your teacher's approval of your plan before you begin any lab work.*

Preliminary Questions

As part of your plan of action, answer the following preliminary questions:

A. How will you separate the water from the other material in the tomato?

B. When you separate the solid part of the tomato from the liquid, the solid part will be wet. While drying the solid, how will you find out how much liquid is being lost in the drying process?

Hints

1. You will need to separate the water from the solids in the tomato.
2. You can speed up the evaporation of liquid tomato from the moistened solid by spreading out the pieces of solid on an already weighed piece of aluminum foil. (Do you see the purpose of weighing the aluminum foil before spreading the mashed tomato on it?)

Lab Report

Your lab report should contain the following: (1) a description of the procedure you followed (which must follow exactly the approved plan of action you devised before you began the lab work); (2) a clearly written record of the data you collected; (3) a description of your observations; (4) any calculations you may have made; (5) answers to the following questions.

END-OF-LAB QUESTIONS

1. What is the percent, by mass, of water in the tomato?
2. The water that you obtained from the tomato was not pure. How did your procedure take this into account? List some of the substances that might be in the liquid.
3. How does the percent of water in a tomato differ from the percent composition of a chemical compound?
4. How do the results you obtained compare with the results of other lab teams working with different tomatoes?
5. If there are significant differences between your results and the results of other teams, how might you account for these differences? How might you go about determining whose result is the most accurate?
6. In the light of your experience in the lab, would you revise your original plan before determining the percent of water in another tomato? If so, how and why would you change your plan?

SIMULTANEOUS PROCESSING SKILL

Definition: To process information visually and pictorially. (From *Learning Style Profile Examiner's Manual*, p. 6) This skill is one of two modes of information processing available to all individuals. Along with sequential or successive processing, strength in this skill is related to an individual's habitual mode of processing information and the nature of a given task. Strength in simultaneous processing indicates an ability to grasp systems of visuospatial relationships, to perceive the separate elements of a whole, and to see the bigger picture when only parts are available. Simultaneous processing involves skill in relational thinking, i.e., perceiving an overall pattern from the relationships among component parts.

Sample Item from the LSP

Look at each form below. Then decide which *one* of the four parts to each question actually comes from that form. The parts are FACING THE SAME WAY as the form, but are larger. Mark the letter of your choice on your answer sheet.

Research Base

Simultaneous processing is based on the work of the Russian psychologist Alexander Luria (1973). He proposed that the brain was composed of three functional units or blocks, each with a structural component of three levels. According to Luria, each block had a specific function to perform and was related to the other blocks. Block two is located in the occipital, parietal, and temporal lobes of the right and left hemispheres. It was in this block that information was processed in two qualitatively different ways, simultaneous and successive. Strength in both modes of processing was deemed crucial to successful performance, and was required in different degrees to perform all tasks.

Various studies indicate that school achievement is related to both simultaneous and successive processing (Das, 1973; Sprecht, 1976). Krywaniuk (1974) found that high achieving third graders were superior to low achieving third graders in all tests of *simultaneous and successive* processing. Das, Manos, and Kanungo (1975) discovered that lower socioeconomic children demonstrated a preference for the successive mode. This finding may well relate to the deprivations in background experience more often found in poor children. They are less likely to have developed the rich cognitive structures to which many visual experiences can be linked. Kirby and Das (1977) concluded that neither one of the information-processing dimensions was more or less important to school achievement. High achievement in school was related to high levels of ability in each processing mode.

Introduction of Simultaneous Processing to the Teacher: Probably less is known about how to help students develop this cognitive skill than any of the others. Yet, to be able to grasp the meaning of something all at once is much like the "aha" experience associated with insight into the solution of a problem which you have been struggling with for some time.

People have the capability of using both simultaneous and sequential processing of information but usually depend more on one than the other for a variety of reasons. Choosing one approach over the other may be a result of habit patterns developed early in life and not altered. Schools usually emphasize sequential processing, thus giving students with this processing tendency an advantage. The fact is that both forms of processing are necessary to succeed in school and in life.

One way of grasping meaning all at once is illustrated in cartoons such as the one below:

THE FAR SIDE cartoon by Gary Larson is reprinted by permission of Chronicle Features, San Francisco, CA.

Note that understanding the cartoon requires that you process all the elements simultaneously to "catch" the humor. Television shows like "Laugh-In" were based on a similar idea. The pun is a type of humor that usually requires an immediate grasp of the idea. Benjamin Franklin quipped at the signing of the Declaration of Independence, "We must hang together or, most assuredly, we shall hang separately." Grasping the meaning of Franklin's statement requires that the reader comprehend the relationship of the parts of the statement.

You could extend this approach by having students look for humor in television commercials or create humorous labels for common objects in the classroom. In a social studies current events lesson, for example, the students might look for newspaper headlines that capture the meaning of the whole page. In other subjects, students could be asked to read the section headings of a chapter and then create one omnibus heading that would capture the essence of the entire chapter.

Simultaneous processing refers to the integration of separate elements into meaningful wholes. This can be accomplished through direct perception (seeing), by extrapolating a visual image when only portions of that image are known or available, or by representing the components of a system simultaneously. The result is processing that enables the student to see higher order meanings (relationships).

Introduction of Simultaneous Processing to Students: When we process information using a simultaneous mode, we use visual cues and insight. Rather than processing things in a step-by-step linear fashion, we grasp the whole meaning at once. We see the "big picture." When we process information using a simultaneous processing mode, we are able to bring together separate parts to form a whole. The formation of the whole does not require that we be aware of all parts or that we see the parts in any particular order. Good simultaneous processors are able to predict or infer how things will end up by viewing only part of the information. When they look at a picture or a graphic, they see something all-at-once. Their processing enables them to grasp relationships by representing all the parts simultaneously.

Strength in processing information simultaneously very often depends on the kinds of experiences we had growing up, at home and in our formal schooling. When we interpret spatial information (e.g., in geometry), we are applying simultaneous processing. When we weave together the intricate visual details of a plot into a meaningful whole or comprehend a complex descriptive narrative, we are applying simultaneous processing. How well we do any or all of these activities depends on the level of our simultaneous processing skill development. Students who do well in school usually are strong in both simultaneous and sequential processing. They are able to adjust to whichever mode is required to succeed in an assignment or activity.

Perhaps an example from a real life situation will help you better understand simultaneous processing and when it is the most appropriate way to process information. You are driving along a major highway in your city or town. The time is 5:00 p.m., the rush hour. People are getting off work and heading home. There is a great deal of traffic. A lot of information is coming at you. In order to negotiate your way through the traffic and arrive at your destination safely, you need to be aware of everything at once. To do otherwise would mean focusing on one car at a time and not being able to grasp what other cars were doing. In grasping the whole, you are using simultaneous processing.

Audience Level: 6th–12th Grade

Cognitive Skill: Simultaneous Processing

Content Application: Various

Activity: Alternate Uses

This activity is based on work done some years ago in creativity. Provide students with a list of common household objects as a warm-up. Ask them to think of many different uses for each of the objects that are different from the ones for which the objects were originally designed. For example, a brick can serve as a paper weight, a door stop, a device for removing wrinkles from a garment, a support for a broken window, etc. The idea is to help students see that objects can have many different uses. The exercise is fun and enlightening. You can expand the exercise to various academic subject areas by giving students a list of objects associated with a subject area and asking them to visualize as many alternate uses as they can. For example, these objects are found in science labs.

BEAKER	MICROSCOPE
PETRI DISH	TEST TUBE
BUNSEN BURNER	TEST TUBE HOLDER
BALANCE	SLIDE

This activity can be done in brainstorming groups or individually. See how long a list of reasonable and alternate uses the class can develop.

Audience Level: 6th–12th Grade

Cognitive Skill: Simultaneous Processing

Content Application: Various

Several other activities can be used to help students practice the skill of simultaneous processing. The following are generic in nature but can be adapted for use in a variety of subject areas.

1. Assign COLLAGE ACTIVITIES in which students are given a topic and asked to illustrate the concept in a holistic way by a collection of pictures cut from old magazines. Some typical topics are hunger, peace, love, joy, responsibility, success, and justice. The possibilities are endless. The idea is to get students to define a concept in ways other than by a series of words or symbols. The collage should help the viewer grasp the meaning of the concept all at once.
2. Employ a TACHISTOSCOPE to present instructional material. The tachistoscope is a machine that presents information to students at varying speeds. It has been used in the teaching of reading, and in helping students to develop a more defined perceptual organization, or both. By viewing words and phrases at speeds ranging from $\frac{1}{10}$ to $\frac{1}{25}$, $\frac{1}{50}$, or $\frac{1}{100}$th of a second, students can be taught to read in thought units. The information is presented on a disk with 10–15 frames. The machine can be used in any subject area. Processing vocabulary words or other information quickly can help students improve the speed of their perceptual organization. The primary purpose is to help them see more, all-at-once, rather than one-step-at-a-time.
3. Use VISUAL ACTIVITIES in which students are given incomplete information and must predict the outcome. Show a film with a story line, for example, stop it at strategic points and ask the students to predict the next part or the outcome. A similar activity can be done with comic strips. Show the students two of four or five frames of a popular comic strip. Ask them to draw what comes next and to complete the story.
4. Create an ADVERTISEMENT. Select an issue of national or international importance such as world hunger, child abuse, or racial injustice and have students develop an advertisement to solve the problem or improve the situation.
5. Prepare SOUND MAPS. Divide the students into task groups and have them record a sound map of the school on a tape recorder. Play the sound maps and have (other) students draw visual maps by listening to the various sounds. You can focus this activity by making sound maps of the science lab, the art room, the library, or the gymnasium. Then move on to world events. Create a sound map, for example, of the Presidential election or the Olympic Games or hostage negotiations.

Reprinted from *Open Mind, Whole Mind* by Bob Samples. Copyright © 1987 B.L. Winch and Associates/Jalmar Press.

Audience Level: 9th–12th Grade

Cognitive Skill: Simultaneous Processing

Content Application: Social Studies, English/Writing

Activity: Hidden Meanings

Ask the students to write a sentence about a concept you are studying in class, such as leadership, justice, freedom, love, balance of power, homeostasis, food chain, DNA, balanced equations, or rectangles. The possibilities are limitless and can apply to any subject matter.

The sentence should consist of 12 or more words. Depending on the class and the students, it may be written independently or in pairs. When everyone is finished, ask a student or pair of students to read a sentence. Record the sentence on the board or overhead projector.

Example: A patriot believes in freedom of expression, equality of opportunity, and the tolerance of others' creeds and opinions.

Display the sentence in this format:

A patriot	of	opportunity	others'
believes	expression	and	creeds
in	equality	tolerance	and
freedom	of	of	opinions

Instruct the students to place their sentences in a similar format. The idea is to have them connect the words from left to right with words that add to the definition of a patriot (or some similar concept). The exercise is designed to expand the students' understanding of a word, definition, or concept.

	A patriot	*is supportive*	of	*real*	opportunity	*for*	others'	*lives because*
he/she	believes	*in the free*	expression	*of ideas*	and	*availability of different*	creeds	
	in	*achieving*	equality	*and*	tolerance	*for both friends*	and	*foes*
who sometimes misuse their	freedom	*and exercise*	of	*choice and*	of	*decision making causing negative*	opinions	*of democracy*

CAUTION: This is not an easy exercise and may cause some students a good deal of frustration. You may wish to work in small groups or with the whole class initially to help students develop the confidence to persist and complete the activity.

(Adapted from: *Open Mind, Whole Mind* by Samples, 1987.)

Audience Level: 6th–12th Grade

Cognitive Skill: Simultaneous Processing

Content Application: Social Studies, Science, English, Physical Education

Activity: Guided Imagery

Have the students sit comfortably and close their eyes. Ask them to relax. Introduce a practice exercise that establishes a set for the more challenging exercise to follow. Ask students to imagine a familiar place or experience. For example, "Imagine yourself inside your house. See the different rooms, their colors, and their furniture. Now, imagine your room as you left it this morning. What did it look like? Was the bed made? Were all your clothes picked up? Look at the walls. Are there pictures, posters, or some other objects on them? What do they represent? Notice as much as you can. Allow your mind to wander, letting images come up from memory. Now, imagine yourself picking up some object in your room. How does it feel—hard, soft? hot, cold? What color is it? What does it smell like?"

When you complete the warm-up, tell students that you are going to transport them back in time so that they can imagine a real historical event as if they were part of it. Instruct them once again to close their eyes and to sit comfortably. Have them place both feet on the floor and their hands on the desk or in their laps. Play an excerpt from the audiotape dramatization of Stephen Crane's *The Red Badge of Courage* or read an excerpt from the novel. (The audiotape is produced by Audio Library Classics and is available in most book stores.)

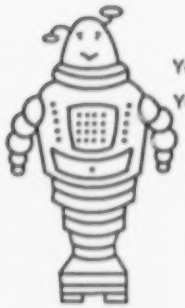
When the excerpt is finished, discuss what different students experienced. See how much information about the Civil War and the circumstances surrounding the war the students can remember. Ask how the soldiers must have felt; what they experienced. Compare and contrast the Civil War with other wars. Talk about visual imagery as a form of learning.

See if the students can think of some other ways to use the approach. In science classes, students can imagine being part of some classic discoveries, such as those of Lavoisier, Curie, Pasteur, and Salk. In English, write a mind journey full of vivid images, read it aloud, and imagine the adventure. In physical education, visualize the end result of an activity rather than the steps to get there. This idea has been described by author Tim Galway in the *Inner Game of Tennis*, in which he teaches the learner to visualize the ball going where she/he wants it to go. Golf professional Bob Toski uses a similar approach, as does Michael Murphy in his book, *Golf in the Kingdom*.

MEMORY SKILL

Definition: To retain distinct vs. vague images in repeated tasks; to detect and remember subtle changes in visual information. (From *Learning Style Profile Examiner's Manual*, p. 3.) Students with strong memory skills are able to recall accurate information when required to do so. Because they store items in memory in an appropriate manner initially, the information is available to them much more readily than to students who show weakness in this skill. The memory skill, like other cognitive skills, is an individual way of responding. Success in school is closely related to skill in remembering information accurately.

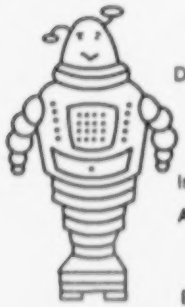
Sample Items from the LSP



Study the picture below carefully!

You will need to remember what it looks like.

You will not be able to turn back to see it again.



Study the picture carefully!

Do not turn back to the page before this one.

Is this picture:

A. The same as the one on the page before this one?

B. Different from the one on the page before this one?

Research Base

Memory is concerned with the ways that individuals connect new information with information previously encountered. The cognitive control principle of leveling and sharpening has been associated with strong and weak memory. Holzman and Gardner (1960) showed that sharpeners were superior to levelers in their recall of old memories. This principle was originally developed to account for performance on two different kinds of tests, one requiring judgment about the sizes of squares and the other requiring accurate judgments over time (Holzman and Klein, 1954).

Researchers have found that sharpeners do better on both kinds of tests because they are attuned to small gradients of difference. Levelers do more poorly because they minimize differences and tend to assimilate new information into that previously experienced. Sharpeners are better able to recover past experiences; levelers are not (Gardner, Jackson, and Messick, 1960). Holzman and Klein (1954) found that knowledge about an individual's tendencies toward leveling or sharpening could be presented visually in a time series. Holzman (1954) replicated this study with items presented auditorily and kinesthetically and obtained similar results.

Santostefano (1985) viewed leveling and sharpening as a phenomenon of development. He observed that leveling was more characteristic of younger children and sharpening more characteristic of older ones. If that is the case, it is likely that older children who retain the tendency toward leveling have not developed their skills effectively and should be capable of improvement with appropriate training.

Introduction of Memory to Students: Memory is crucial to all learning. All of us have had the experience of trying to remember something we thought we had learned. When taking a test or an examination, we sometimes struggle to remember the answer to a specific question. We have studied the material, but somehow we are not able to recall it when we need to answer the question.

On the other hand, we rarely forget how to do something important or pleasurable once we have learned it. We can go for weeks, months, and even years without riding a bicycle or skating, and then with minimum practice do so again with relative ease. What is the difference between remembering how to do something and remembering information in school? In large measure, it may have to do with how we learned the information in the first place.

School information not retained in memory cannot be remembered at all. School information memorized for brief use might be remembered for a short time, but then it is forgotten. School information integrated into what we already know is very often remembered as part of something bigger than itself. School information understood and applied to a real-life situation becomes a permanent part of our memories. We never forget it. This latter type of learning is what happens when we learn to ride a bicycle or to skate.

Research has shown that we remember things best that are *first*, that are *recent*, that are *linked* to our experiences (things we know), and that are *outstanding or different*. But remembering is not the same as learning; it only forms the basis for learning. When something is learned, it stays with us forever. It can be recalled when needed because it is part of a larger structure with all kinds of associations and linkages.

Knowing this, what can you do to improve the likelihood that your school information will be retained long enough to be integrated, assimilated, associated with, or differentiated from the information you already know? Several strategies are possible. To emphasize the first and recent, you can plan frequent breaks in your learning so that there are more firsts and more recents as you study new material. You can do warm-up exercises before studying just as you do warm-ups before doing physical exercise. Memory warm-ups by reviewing materials previously studied ready the mind to learn. You can highlight and emphasize material in different ways by the strategic use of color, drawings, and emphasis.

A particularly useful memory strategy is called mnemonics (from the Greek word "mneme" meaning "to remember"). Everyone has used at least one mnemonic device to remember something. The lines of the treble clef in music are usually remembered by the mnemonic *E*very *G*ood *B*oy *D*oes *F*ine, or the reciprocal of pi (0.318310) in mathematics by the phrase "Can I remember the reciprocal?" The number of letters in each word recalls the required numbers: Can = 3; I = 1; remember = 8; the = 3; reciprocal = 10. The sentence *P*oor *C*hildren *N*ever *E*ver *H*ave *G*ood *B*reakfasts may be used to remember the countries of Central America. *M*en *V*ery *E*asily *M*ake *J*obs *S*erve *U*seful *N*eeds *P*romptly is a way to remember the names of the planets.

The following activities are designed to help you sharpen your memories. Most are focused on short-term or working memory as the building blocks for more substantial learning.

Audience Level: 6th–12th Grade

Cognitive Skill: Memory

Practice Activity: Simple Recall

Objective: To practice remembering exact patterns.

Procedure: Write the lines from the following poem on the blackboard or on a transparency. Ask students to hold the lines in memory as a *standard*. Then write or show the five variations and ask students to decide whether they are the same or different.

Standard: Snow is falling, falling down
falling all around the town.
It falls on me, it falls on you
A pale and silent guest.

(Remove the standard when showing the variations.)

1. Are these lines of poetry the same as the standard? If not, how are they different?
   Snow is falling, falling down
   falling all around the town.
   it falls on me, it falls on you
   A pale and silent guest.
2. Are these lines of poetry the same as the standard? If not, how are they different?
   Snow is coming, falling down
   falling all around the town.
   It falls on me, it falls on you
   A pale and silent guest.
3. Are these lines of poetry the same as the standard? If not, how are they different?
   Snow is falling, falling down
   falling all around the town.
   It falls on me, it falls on you
   A pale and quiet guest.
4. Are these lines of poetry the same as the standard? If not, how are they different?
   Snow is falling down
   falling all around the town.
   It falls on me, it falls on you
   A pale and silent guest.
5. Are these lines of poetry the same as the standard? If not, how are they different?
   Snow is falling, falling down
   falling all around the town.
   Snow falls on me, it falls on you
   A pale and silent guest.

Audience Level: 6th–12th Grade

Cognitive Skill: Memory

Practice Activity: Linking

Objective: To practice the memory technique of Linking.

Procedure: Describe and illustrate the Link System as a technique to remember things. The Link System is used to remember things in *sequence only*. Many things must be remembered in this way. A speech is a sequence of thoughts; a formula is a sequence or series of components; any number with more than two digits is a sequence.

A problem with Linking, only at first, is in making the linking pictures *ridiculous*. Four simple rules will help you do this right from the start.

1. The easiest rule to apply is the rule of *Substitution*. Picture one item instead of the other.
2. A second rule is *Out of Proportion*. Try to see the items larger than life. Make everything gigantic (or very small).
3. Another rule is *Exaggeration*. Try to see "millions" of an item.
4. Get *Action* into your pictures. Action is always easy to remember.

It takes imagination to form ridiculous pictures in your mind. The important thing is that simply applying the system will give us practice. The imagination will improve, as well as our powers of observation.

Guide the students through this example:

Assume you want to remember these 10 items in sequence: shark, baseball, olive, shoe, flower, cloud, salt, popcorn, tree, and book.

Begin by picturing a *shark*. The new information that you want to remember is *baseball*. Form a ridiculous association between those two items. It could be: a gigantic pink shark playing baseball. The next item is *olive*. You might see the game being played with a big green olive. The next item is a *shoe*. Picture the olive being hit into a shoe that has a purple *flower* on it. That flower grows and grows and reaches all the way to the *clouds*. The clouds are full of *salt* and the salt falls down on a huge string of *popcorn*. The popcorn string covers all the *trees* in the city. The trees are all reading a big picture *book*. If you have visualized truly vivid pictures, you will have made the associations and will be able to recall the 10 items in sequence.

Have several students recall their associations while reciting the list of 10 items. Make a list of 10 new items and have the students repeat the technique. You might want to practice with a shopping list or a list of errands.

Content Application: This technique can be used in any content area that has information to be learned in sequence (a speech, formula, list of dates, or rulers in the order of their reigns).

(For additional information, see *The Memory Book* by Harry Lorayne and Jerry Lucas, Ballantine Books, 1974.)

Audience Level: 6th–12th Grade

Cognitive Skill: Memory

Content Application: Various

Activity: Chunking

It has been documented that the mind can hold seven bits of information at any one time, plus or minus two. Any information in excess of five to nine bits is more likely to be lost.

The amount of information in the seven bits can be increased by reorganizing the material into larger *chunks*. Each chunk should contain a large amount of information. The more information you can include in each bit, the more you will be able to remember. The mind remembers the chunks, not the amount of information.

In remembering a person's telephone number, we usually divide it into three parts, the area code, the exchange, and the number. When trying to spell a word such as "antidisestablishmentarianism," we can also divide the task into manageable chunks, or parts: anti-dis-establish-ment-arian-ism. If you can remember larger chunks at one time, of course, you can increase the amount of space you have available to store and remember other chunks.

Consider the following list of words: Washington, police, depression, discrimination, farewell, family, car, equation, address, great, tree, ethnic, balance. Read over the list quickly. Close your eyes and see how many words you can recall. Now, see what happens when you reorganize the word list into larger chunks:

Washington's Farewell Address
Great Depression
police car
balance equation
ethnic discrimination

Reorganizing the words into 6 chunks of information rather than 13 makes the list easier to remember.

This principle of memory can be used in any number of situations to increase the amount of information to be remembered. The chunking strategy helps people improve their short-term memories. As a person becomes more familiar with the content of a subject, she/he finds it much easier to chunk information. The more information chunked into one bit, the more memory capacity is freed.

Audience Level: 8th–12th Grade

Cognitive Skill: Memory

Content Application: American History

Activity: Pegword and Place Methods

Suppose that it is important for students in an American History class to memorize, in order, the first 10 presidents of the United States. Actually, assignments such as this are probably rare these days, but those requiring students to memorize lists of terms, formulas, important events in chronological order, etc. are still common.

The *pegword method* for memorizing a list associates each item with a rhyming word for the number it represents. The common pegwords for each number are the following:

one = bun
two = shoe
three = tree
four = door
five = (bee)hive
six = sticks
seven = heaven
eight = gate
nine = line
ten = hen

For the example above, match the presidents in order by associating their names with the pegwords. The first president was George Washington. Form an image of Washington with a breakfast bun. Picture George seated at the dining room table with Martha eating the biggest cinnamon bun you ever saw. The second president was John Adams. Form an image of Adams and a shoe. Think of the Adams shoe company in Adams, Massachusetts. (They manufacture a shoe for high school students called the Adams flyer.) The third president was Thomas Jefferson. Form an image involving Jefferson and a tree. Let's say that Tom Jefferson is a world-renowned tree climber. (In fact, he is listed in the *Guinness Book of Records* for the most trees climbed in a year.) You continue forming associations until you include all 10 Presidents. To recall the list, start with "one is bun" and recall the word associated with bun. Proceed down the list, recalling all 10 presidents in order. It is important that the pegword list become so familiar that remembering "one is bun" and "two is shoe" is second nature.

The *place method* is a variation of the pegword approach. This method is based on the Roman system of remembering items by associating them with a specific locus or location. (*Locus* is the Latin word for place.) You begin by becoming familiar with a standard list of locations. Take a familiar room and divide it into four sections of 10 places each. Remembering 40 historic events can be accomplished by associating each event with a specific section and place in the room. The first event goes with space one in quadrant one. The second event goes with space two in quadrant one, and so forth. To recall the events, visualize the room at each space in order.

These procedures can be used for any subject area.

Audience Level: 6th–12th Grade

Cognitive Skill: Memory

Content Application: Foreign Language or Vocabulary (Any Subject)

Activity: Key-Word Method

The purpose of the key-word method is to help students associate pairs of words or two sets of information, like a word and its definition, or a country and its chief exports/imports, or states and their capitals. In foreign language vocabulary learning, students are given a list of words in the second language, say Spanish, with their English definitions. Students are asked to memorize the Spanish equivalents of the vocabulary list.

The key-word method begins by changing the Spanish word into an easily pronounced English word that sounds like the Spanish word. *Carta*, for example, can be converted to *cart* and *biblioteca* can be converted to bibliography. Next, an image is created to associate the key-word with the English translation of the Spanish word. The more emphasis or exaggeration associated with the link, the better the student will remember. For *carta*, the student could picture a large letter in a grocery shopping cart.

For *biblioteca*, the student could picture someone coming out of the library balancing a large stack of books for his bibliography.

This approach can be used to link definitions with vocabulary words in science, social studies, English, or any subject. To learn the definition of "cantankerous," for example, the word *canter* could be the key-word, with the image of a horse about to throw the rider. The definition of "profligate" could be remembered by using *profit* as the key-word and picturing a man or woman making many purchases in a store. Other key-words could link inventors with their inventions, historical persons with important events, and chemicals with their functions.

Note: Research studies in foreign language suggest that the key-word method works best when the teacher provides the key-word and the students form their own images.

(Adapted from *Educational Psychology: A Cognitive Approach* by Mayer. See also Atkinson and Raugh, 1975, and Pressley and Levin, 1978.)

Audience Level: 6th–12th Grade

Cognitive Skill: Memory

Content Application: Various

Activity: Structural Techniques

Students frequently must read a paragraph, a chapter, or a book. Some students undertake the task and comprehend the meaning easily, while others struggle to discover any meaning. Students can comprehend what they read and remember it by looking for a structure in the material, by connecting the key ideas, linking them together and relating them to personal experience.

Procedure: Place students in learning teams of four to five persons. Appoint a recorder. Give the teams about 20 minutes to read the passage below and structure the information into main themes and ideas. Have each team record its structure on the chalkboard, a transparency, or a sheet of chart paper. Discuss each structure, noting the strengths and weaknesses of each. Try to develop a consensus of the best way to structure the passage for effective recall.

The following is one way the information might be structured:

Statement of the Theme: Concern for enemies within the U.S.

Historical Reasons for Concern: The events of the 1920s and 1930s

Later Reasons for Concern: German military successes in Europe, especially France

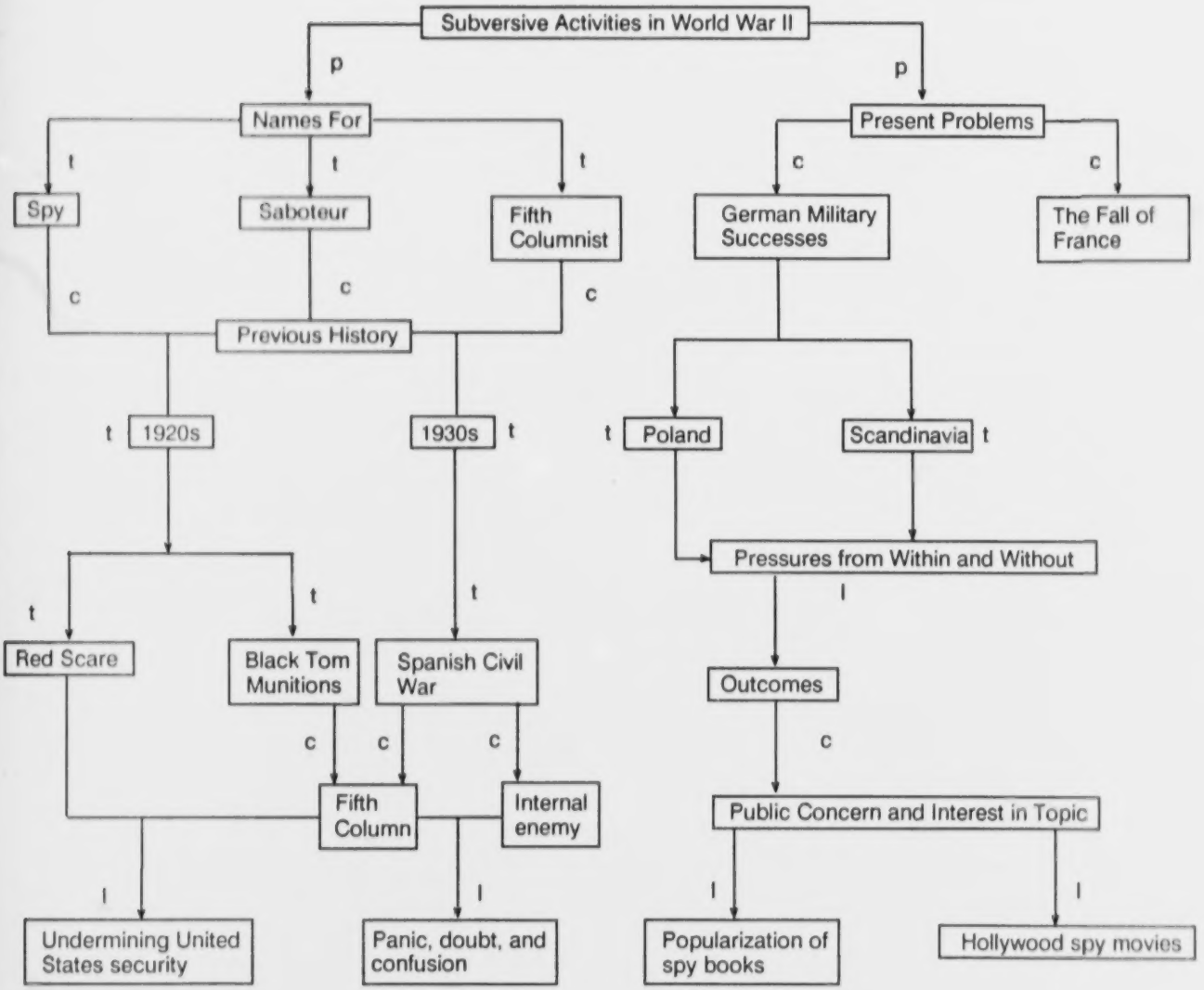
Results of the Perceived Problem: Popularization of spy books and movies

Alternate Topics: Another way to organize the same passage is by using the technique of *networking*. This technique links together key ideas, showing *how* the ideas relate to each other. Students working individually or in pairs would develop a pictorial representation of the "The Enemy Within" paragraph like the example on the following page.

Example: The Enemy Within

By December 1941, both the American people and government had developed an acute sensitivity to the spy, the saboteur and the fifth columnist. Much of the preoccupation could be traced to World War I, for millions of Americans remembered the Black Tom munitions explosion and other exploits—real or fabricated—of the Kaiser's secret agents. The Red Scare which had followed had helped to impant the image of the hidden, relentless subversive, boring away at the nation's vital core like the worm inside an apple. As war clouds gathered in the thirties, the image grew. The Spanish Civil War contributed both the phrase "fifth column" and the notion of an internal enemy poised to create panic, doubt and confusion—all in perfect coordination with forces attacking from the outside. In the American mind, the German military successes in Poland and Scandinavia were almost as much the work of the fifth column as of the Wehrmacht. But it was the astounding collapse of France which has most awesomely shown how a sizable nation with a highly regarded army could simply disintegrate under combined pressures applied from within and from without. By the time France fell, books on the danger of subversion were finding a ready market, as were sensationalist exposés that told of a hundred thousand—or million—seemingly loyal Americans waiting silently for orders from Berlin. Hollywood found in the "spy movie" a rich vein, which it continued to mine well into the war.

Reprinted with permission of Charles Scribner's Sons, an imprint of Macmillan Publishing Co. from "The Enemy Within" in *For the Duration* by Lee Kennett. Copyright © 1985 Lee Kennett.



p = part of
t = type of
l = leads to
c = characteristic of

Audience Level: 9th–12th Grade

Cognitive Skill: Memory

Content Application: Various

Activity: Notetaking by MIND MAPS

Procedure: Tony Buzan, noted British psychologist, has developed a technique for taking notes that combines many of the best ideas about memory. He says that taking notes in sentences runs contrary to the way our brains operate. A better approach is to use key symbols, images, numbers, and codes, as well as key words, to enhance recall. MIND MAPS, as he calls his technique, patterns information so that its representation is more concrete and more balanced.

In making a MIND MAP, the student begins by placing the major idea in the center of the paper and working outward from the center in all directions using key words, images, numbers, etc. The patterning of information shows how things fit together. A generous use of color, diagrams, and drawings can capitalize on the brain's propensity to recall visual images more easily than words.

Students will be aided in constructing MIND MAPS by remembering several guidelines.

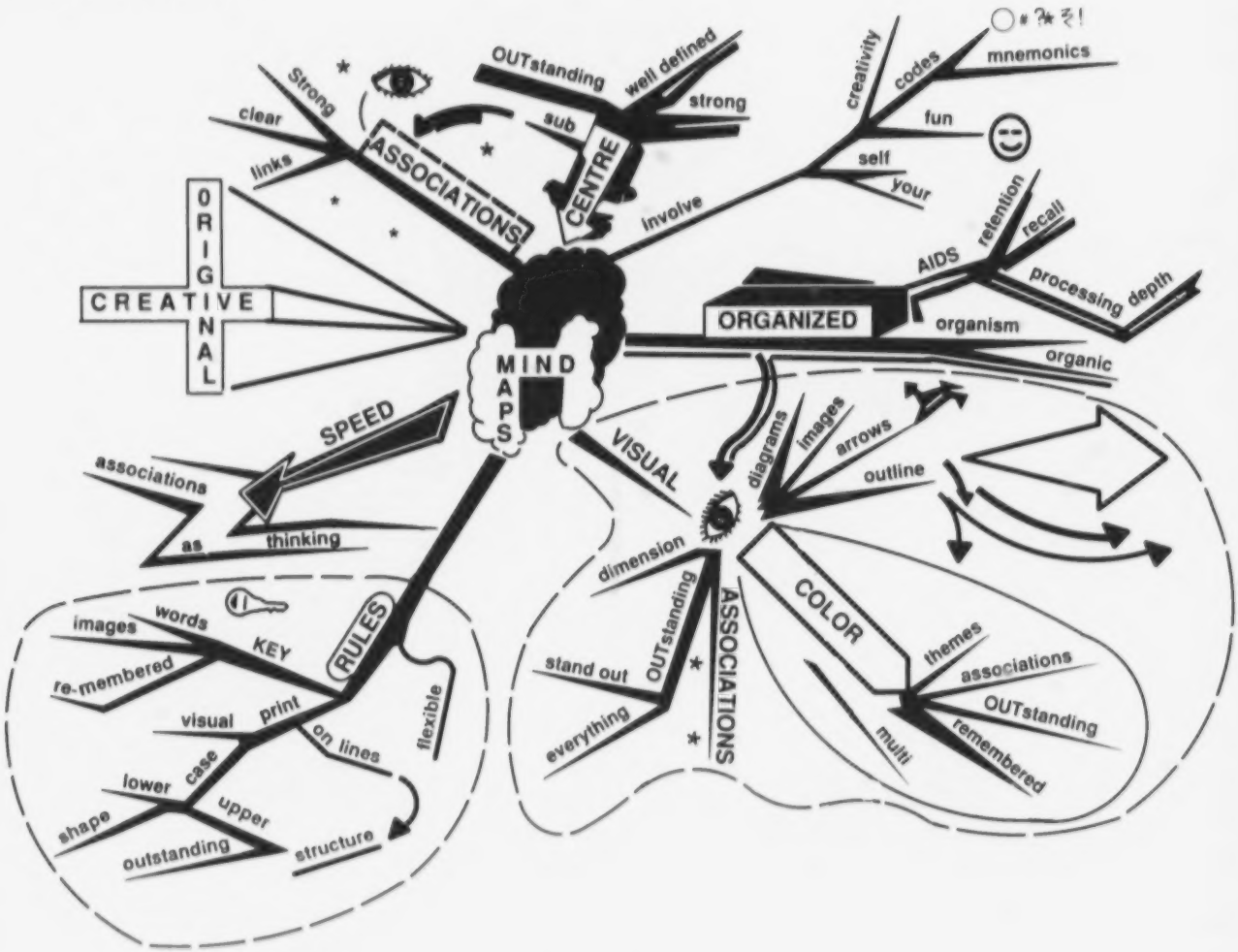
1. The main idea usually has several sub-ideas that support it. Keep the number of sub-ideas to about seven, chunking information in accordance with the brain's known capacity.
2. In further developing the sub-ideas, again restrict the number of chunks to the working capacity of the short-term memory.
3. Use single words or short phrases.
4. Print each word, using lower case letters as much as possible. Use CAPITAL LETTERS for emphasis.
5. Print each word on a line; join the lines together rather than the words.
6. Use several colors rather than just black and white. (Colored pencils or pens are important learning tools.)
7. Try to work in some three-dimensional images.
8. Link ideas with arrows.

MIND MAPS may be used for notes in any subject and to outline the structure of books, lectures, meetings, interviews, daily tasks, etc. Some presenters copy the MIND MAP on a transparency so that the audience can follow along.

The following example of a MIND MAP, on the next page, is found in *The Brain Book* by Russell (1979).

COGNITIVE SKILL: MEMORY

MIND MAP EXAMPLE



Audience Level: 6th–9th Grade

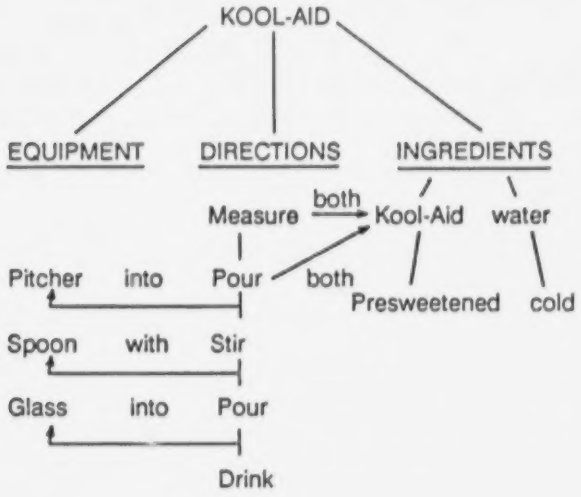
Cognitive Skill: Memory

Content Application: Various

Activity: Idea Tree

Procedure: A simplified form of networking using sub-ideas, connectives, and arrows.

Example: PRE-SWEETENED KOOL-AID
To make pre-sweetened Kool-Aid, a large container such as a pitcher or bottle, a spoon, and a glass are the necessary pieces of equipment. The ingredients are Kool-Aid and water. The directions for making Kool-Aid are easy to follow: Measure the Kool-Aid and pour into the pitcher, add cold water, and stir vigorously. The Kool-Aid is ready to pour and drink.



Audience Level: 9th–12th Grade

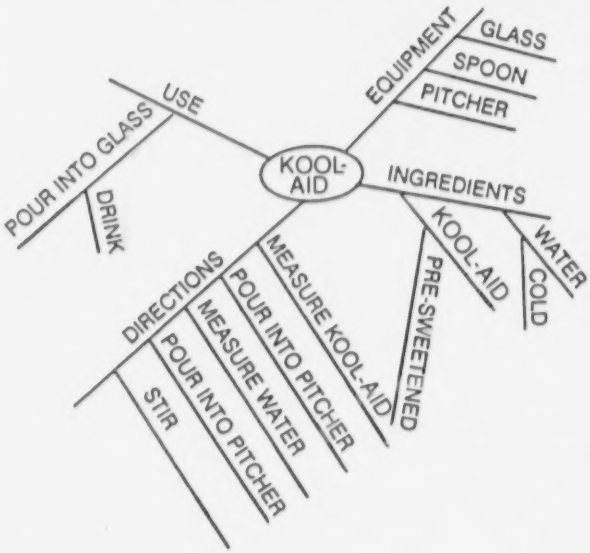
Cognitive Skill: Memory

Content Application: Various

Activity: Concept Map

Procedure: A simplified version of the MIND MAP using sub-ideas and diagraming.

Example: PRE-SWEETENED KOOL-AID
To make pre-sweetened Kool-Aid, a large container such as a pitcher or bottle, a spoon and a glass are the necessary pieces of equipment. The ingredients are Kool-Aid and water. The directions for making Kool-Aid are easy to follow: Measure the Kool-Aid and pour into the pitcher, add cold water, and stir vigorously. The Kool-Aid is ready to pour and drink.

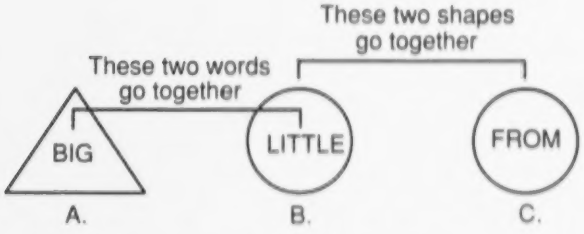


VERBAL-SPATIAL PREFERENCE

Definition: Some students prefer *verbal tasks*, and some students prefer *spatial tasks*. It is a matter of individual preference and may relate to what an individual student has become accustomed to growing up or in the process of formal schooling. Students who prefer verbal tasks usually perform better when taught in that manner. Students who prefer spatial tasks perform better when taught in that manner. It is helpful to teach students in accordance with their preferences for new or difficult learning, and to help them learn how to transform situations to their preferences.

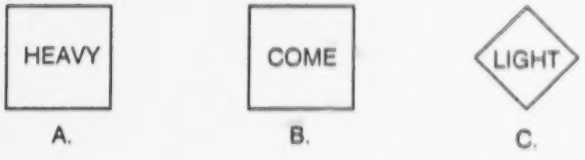
Sample Items from the LSP

Two WORDS or two SHAPES can go together in the questions below.



Decide for each question if you like the two words or the two shapes. Then mark your answer sheet:

A. if you like the WORDS
B. if you like the SHAPES



Research Base

Individual differences in learners have been the basis for many suggestions to improve teaching and learning in schools. Studies have hypothesized that to the degree individual characteristics can be diagnosed and appropriate prescriptions implemented, student learning will increase. Cronbach and Snow (1977) advanced the notion that one can and should expect interactions between learner characteristics and instructional methods. This observation led to a whole series of studies that examined the interaction effects between the subjects of the experiments (the students) and the treatments (the methods of teaching).

A preference for verbal tasks may or may not be related to an ability to process information sequentially; it may or may not be related to an ability to process information simultaneously (Keefe and Monk, 1988). The point to remember is that verbal-spatial is a preference for one kind of task or presentation of information over another. No clearcut correlations exist between verbal-spatial preference and any other LSP subscale. The preference is independent and can exist in combination with other types of skills or preferences. The orientation is cognitive in function, however, and for that reason it is grouped with the cognitive skills.

Introduction of Verbal-Spatial Preference to Students: The teacher should help students to understand that preference means a *preferred way of doing things*. For example, most people write with their right hand, but some use the left hand. When anyone tries to switch from his/her preferred way of writing, it feels "funny" or awkward. He is doing something he is not used to doing.

Preference for verbal or spatial tasks is similar to handwriting. Some of us like to do things that are verbal, while others prefer things that are spatial or non-verbal. Reading a book or writing an essay are examples of verbal tasks. Constructing a graph or drawing a picture are examples of spatial tasks.

Neither way is better than the other; it is just a matter of preference. One way feels more comfortable than the other. When given a choice, "verbal people" choose verbal activities and "spatial people" choose spatial activities. There is also some evidence that when we are taught the way we prefer to learn, we learn more.

The Activities: The way most teachers teach places more emphasis on verbal activities than spatial ones, with the possible exception of subjects with more spatial tasks, like geometry, drafting, and art.

Much of what teachers do in the classroom emphasizes preference for verbal tasks at the expense of spatial tasks. Because teachers stress verbal activities such as reading a textbook or an article, writing a formal paper or answers to questions, note taking, outlining, lecturing, and discussing, we have chosen to cite sample activities here that are *spatially* oriented, in a variety of subject areas.

Audience Level: 6th–12th Grade

Cognitive Skill: Verbal-Spatial Preference

Content Application: English

Activity: The Sun-Shadow Mandala

The purpose of this one-week lesson is to facilitate student writing skills with spatial task orientation. It is based on the work of Mary Frances Claggett of the Bay Area Writing Project and Alameda High School, as modified by Vicki Clifford of the P. K. Yonge Laboratory School.

Day One: Completing a Mandala chart. Students fill out the chart by naming one thing that they identify with or admire in seven different categories. This is called the Sun Image. In the column next to the words, students list one adjective that describes the selection. Next, they list something they do not identify with or admire, again using the seven categories. This list is the Shadow Image. In the last column, students describe the shadow words using one adjective per word.

Day Two: Constructing sentences explaining the paired choices (each image and its quality). For example, I admire the quality of _____ in a _____ because _____. OR I identify with the quality of _____ in a _____ less because _____.

Days Three and Four: Making the Mandala itself. Have the students draw a large circle on a sheet of plain paper. (The paper may be white or any color.) Have them arrange all the Sun and Shadow images, 14 in total, within the circle by drawing them or representing them symbolically. The students may want to divide the circle into two parts, the Sun images (positive/public) in one half and the Shadow images (negative/private) in the other. Students should be encouraged to make their Mandalas attractive by using colored pencils, pens, or markers. At the end of the fourth day, share some of the Mandalas with the class.

Day Five: Have the students write two sentences, one using all the Sun Images and their qualities (14 words), the other using all the Shadow Images and their qualities (14 words). Arrange the two sentences around the exterior circumference of the circle. Usually the Sun sentence is placed on the half of the circle with the Sun Image drawings or symbols and the Shadow sentence on the half of the circle with the Shadow Image drawings or symbols.

Homework: Have students focus on an aspect of one of their sentences and write a paragraph or story to go with it. The length of the writing assignment can be a matter of individual choice. A well-written paragraph capturing the essence of the Sun or Shadow images and qualities would be enough.

Audience Level: 6th–8th Grade

Cognitive Skill: Verbal-Spatial Preference

Content Application: Social Studies

Activity: Longitude and Latitude

Arrange the classroom into five rows with six desks in each row. Draw a schematic of the classroom rows and seats on an acetate and place on an overhead projector. Project the schematic on a screen. Row one should be labeled with a Roman numeral "I," the second row "II," and so on through "V." Each desk in each row should be labeled with a letter from "A" to "F."

Stand at the doorway and, as students enter the classroom on a given day, hand them a 3×5 card with a location listed (e.g., IA or IIF). Tell students that the card indicates where they will sit for the next unit of work and that the place can be located by finding their seat on the chart projected on the screen. This exercise may cause a little confusion, but only at first. Soon, the students will understand and with little trouble find their new seats.

The experience of locating oneself on a seating chart is similar to the use of longitude and latitude. The intersection of the horizontal and vertical lines establishes with precision where to sit. Show students how we also use horizontal lines (rows) and vertical lines (seats) on a globe to establish location. This process can help students understand the concept of place location on a globe or map, and perhaps even to discuss basic navigation and other ideas.

Other Activities

Typically, social studies classes are conducted with lectures, discussion, or textbook reading. To break this type of lock-step approach, ask students to take old magazines and construct a collage of pictures that defines abstract concepts such as democracy or peace. Once constructed, students should explain why they selected each of the pictures.

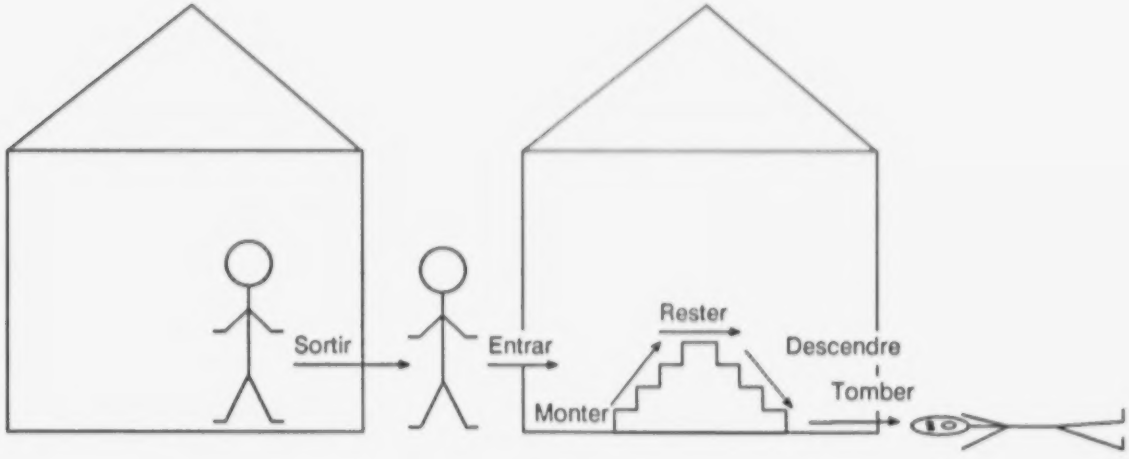
Audience Level: 9th–12th Grade

Cognitive Skill: Verbal-Spatial Preference

Content Application: Foreign Language

The following activities were developed and are used by Jonita Stepp, teacher of French and Spanish at P.K. Yonge Laboratory School.

1. To teach French verbs, ask students to draw two houses with people in them and to label the following actions: to leave, to enter, to go up, to stay, to go down, and to fall down. Once they have labeled the actions within the house, have them write a story about what is happening.



2. To teach new vocabulary or to review, paste pictures cut out from catalogs on 3x5 cards. Use these pictorial flash cards as an alternative to the usual word versions.
3. Conduct a scavenger hunt of familiar objects. Students must name the objects in the foreign language as they find them.
4. Make an album of family pictures. Label each member of the family in French or any other target language.
5. Have a fashion show in which students describe each other's clothing in French, Spanish, German, etc.
6. Have students act out various commands presented in the second language. For example, "Close the door," "Open the window."
7. Have students pantomime a series of different grooming activities presented in the second language; e.g., brushing teeth, combing hair.
8. Ask students to close their eyes and visualize non-concrete words spelled out in their favorite bright colors–hot pink, neon blue, chartreuse. Of course, they must visualize the words in the second language.
9. To teach *command words*, have students: (a) Prepare an advertisement about a specific product and use commands to convince people to buy the product; (b) Develop "how to" demonstration speeches with props; e.g., how to make a peanut butter sandwich or how to set a table. Students must use commands such as "put," "set," etc. in the speech.

Audience Level: 6th–8th Grade

Cognitive Skill: Verbal-Spatial Preference

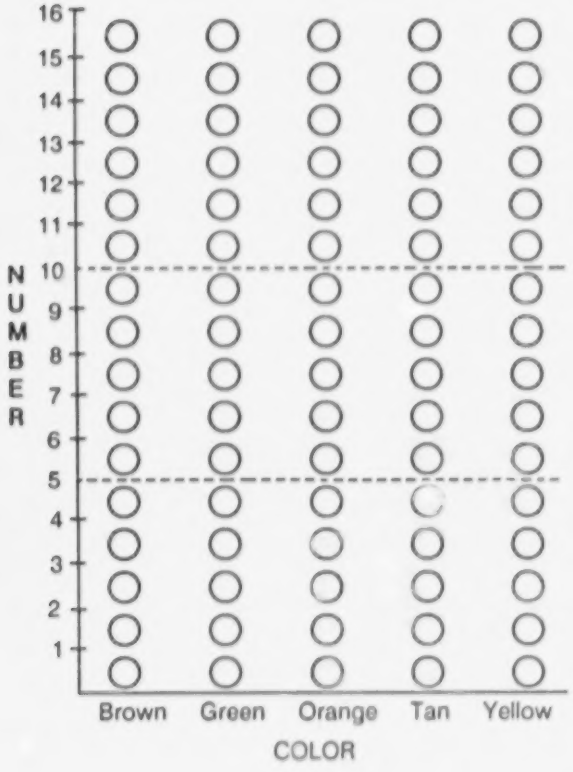
Content Application: Mathematics

Objective: Graphing

Materials: Packages of M&Ms for each student

Activity: Begin by reminding students that M&Ms come in five colors. The task is to guess which colors will occur most often and least often in the unopened packages you distribute.

Ask students to open the packages and arrange the various colored pieces on a graph similar to the sample below. Have them compile the data for their own packages, and then compare the results with one other student. They should mark the highest circle for each color and shade the circles below it. (If they want to eat the M&Ms after they have completed the exercise, it is all right.)



When all graphs have been completed, hold a class discussion about the differences in the students' counts. Suggest that a *class* chart be made. Prepare five acetates in advance, one for each color to facilitate the collection of the data, as shown below.

GREEN M&Ms

NUMBER IN PACKAGE	TALLY	FREQUENCY	TOTAL
0			
1	1	1	1
2	1	1	2
3	1111	4	12
4	11111 111	8	32

By a show of hands, have the students report the number of the different colors in each package. Do all five colors. Have a class recorder list the appropriate tallies for each color. Record the grand totals on a sixth acetate as follows:

COLOR	TOTAL
BROWN	
GREEN	
ORANGE	
TAN	
YELLOW	
CLASS TOTAL	

Now, distribute a second graph similar to the one they originally used to visualize the tallies. Have each student develop a scale to record the data; e.g., one circle equals 20 or 25 M&Ms. Have them shade the appropriate number of circles using their scales. When a graph has been completed for the class data, have them compare the tallies from their individual packages for similiarities and differences.

You can have them speculate on how they would graph a 2-pound package of M&Ms. You could introduce the concept of sampling by having the students draw samples of 10 or 20 M&Ms from the large package to estimate the distribution of the entire package.

From *Statistics and Information Organization*, by University of Oregon Mathematics Resource Project. Copyright © 1977 by University of Oregon, published by Creative Publications, Sunnyvale, Calif. Reproduced with permission.

Similar exercises can be found in *Statistics by Example, Exploring Data*, by F. Mosteiler, et al. Addison-Wesley Publishing Company, Inc.

Other Activities

1. Creative exercises for geoboards and geocubes can be found in MATHIMAGINATION, Book F, Creative Publications, Inc. and GEOBOARD ACTIVITY CARDS, Scott Resources, Inc.
2. Christian R. Hirsch, in "Finding Factors Physically," (*Mathematics Teacher*, May 1982) offers an excellent method for factoring quadratic polynomials using physical models. Students are able to discover regularities by using cutouts.
3. Line-Symmetry in geometric figures can be taught using a device called a MIRA. The MIRA is placed in the center of various shapes to help students decide whether or not the shape is symmetrical by looking at the mirror image. See the example on the next page.

A MIRA can be purchased from Creative Publications, 5040 West 111th Street, Oak Lawn, Illinois 60453 for approximately $6.95 each.

From *MIRA Activities for Junior High School Geometry*, by N.J. Gillespie. Copyright © 1973 by Mira Math Co., published by Creative Publications, Sunnyvale, Calif. Reproduced with permission.

COGNITIVE SKILL: VERBAL SPATIAL

EXAMPLE OF LINE-SYMMETRY IN GEOMETRIC FIGURES

Use your MIRA to draw lines of symmetry on the following figures.

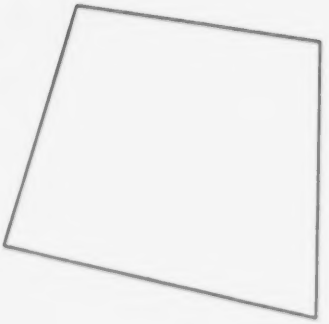
Use your MIRA to locate corresponding parts of each figure.

Using a pencil, point to a part of the figure in front of the MIRA. The image pencil points to the corresponding part behind the MIRA.

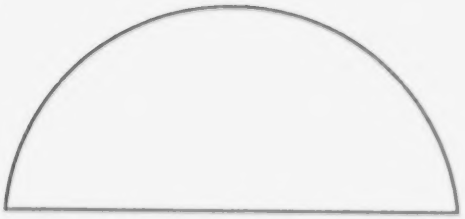
Corresponding parts are congruent. Same shape, same size.

a)

b)



c)



d)

e)

f)

SELECTED REFERENCES

Analytic Skill

Black, H., and Black, S. *Building Thinking Skills, Book 3-Verbal*. Pacific Grove, Calif.: Midwest Publications, 1985.

Goodman, H. D.; Emmel, T. C.; Graham, L. E.; Slowiczek, F. M.; and Shecter, Y. *Biology*. Orlando, Fla.: Harcourt, Brace, Jovanovich, 1986.

Guild, P. B., and Garger, S. *Marching to Different Drummers*. Alexandria, Va.: Association for Supervision and Curriculum Development, 1985.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Examiner's Manual*. Reston, Va.: National Association of Secondary School Principals, 1986.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Technical Manual*. Reston, Va.: National Association of Secondary School Principals, 1986.

Pemberton, C. L. "The Closure Factors Related to Temperament." *Journal of Personality* 21(1952):159–75.

Piaget, J. *The Construction of Reality in the Child*. New York: Basic Books, 1954.

Witkin, H. A.; Dyk, R. B.; Faterson, H. F.; Goodenough, D. R.; and Karp, S. A. *Psychological Differentiation*. New York: John Wiley and Sons, Inc., 1962.

Spatial Skill

Bennett, G. K.; Seashore, H. G.; and Wesman, A. G. *Different Aptitude Tests*, 3rd ed. New York: Psychological Corp., 1959.

French, J. W.; Ekstrom, R. B; and Price, L. A. *Manual for Kit of Reference Tests for Cognitive Skills*. Princeton, N.J.: Educational Testing Service, 1963.

Harris, L. J. "Sex Related Variations in Spatial Skill." In *Spatial Representation and Behavior Across the Life Span*; edited by L. S Liben, A. A. Patterson, and N. Newcombe. New York: Academic Press, 1981.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Examiner's Manual*. Reston, Va.: National Association of Secondary School Principals, 1986.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Technical Manual*. Reston, Va.: National Association of Secondary School Principals, 1988.

Liben, L. S.; Patterson, A. A.; and Newcombe, N. *Spatial Representation and Behavior Across the Life Span*. New York: Academic Press, 1981.

McGuiness, D. "Sex Differences in the Organization of Perception and Cognition." In *Exploring Sex Differences*, edited by B. Lloyd and J. Archer. New York: Academic Press, 1976.

Metzler, J., and Shepard, R. N. "Rotation of Tri-Dimensional Objects." In *Theories in Cognitive Psychology: The Loyola Symposium*, edited by R. L. Solso. New York: Wiley, 1974.

Sutton-Smith, B. "The Play of Girls." In *Becoming Female: Perspectives on Development*, edited by C. B. Koop. New York: Plenum, 1977.

Discrimination Skill

Gardner, R.; Holzman, P. S.; Klein, G. S.; Linton, H.; and Spence, D. P. "Cognitive Control: A Study of Individual Consistencies in Cognitive Behavior." *Psychological Issues* 4(1959):46–52 and 82–89.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Examiner's Manual*. Reston, Va.: National Association of Secondary School Principals, 1986.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Technical Manual*. Reston, Va.: National Association of Secondary School Principals, 1988.

Piaget, J.; Vinh-Bang; and Mantalon, B. "Note on the Law of the Temporal Maximum of Some Optico-Geometric Illusions." *American Journal of Psychology* 71(1958):277–82.

Schlesinger, H. J. "Cognitive Attitudes in Relation to Susceptibility to Interference." *Journal of Personality* 22(1954):354–74.

Categorization Skill

Bruner, J. S.; Goodnow, J. J.; and Austin, G. A. *A Study of Thinking*. New York: Wiley, 1956.

Gardner, R. W. "Cognitive Styles in Categorizing Behavior." *Journal of Personality* 22(1953):214–33.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Examiner's Manual*. Reston, Va.: National Association of Secondary School Principals, 1986.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Technical Manual*. Reston, Va.: National Association of Secondary School Principals, 1988.

Letteri, C. A. "The Measurement of Correlates of Category Width as a Cognitive Variable." *Journal of Personality* 26(1985):532–44.

Pettigrew, T. F. "The Measurement and Correlates of Category Width as a Cognitive Variable." *Journal of Personality* 26(1958):532–44.

Sequential Processing Skill

Claggett, M. F. *Balancing the Hemispheres: Brain Research and the Teaching of Writing*. Berkeley, Calif.: University of California Bay Area Writing Project, 1980.

Das, J. P. "Structure of Cognitive Abilities: Evidence for Simultaneous and Successive Processing." *Journal of Educational Psychology* 65(1973):103–08.

Das, J. P.; Kirby, J. R.; and Jarman, R. F. *Simultaneous and Successive Processing*. New York: Academic Press, 1979.

Das, J. P.; Manos, J.; and Kanungo, R. N. "Performance of Canadian Native, Black, and White Children on Some Cognitive and Personality Tasks." *Alberta Journal of Education Research* 21(1975):183–95.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Examiner's Manual*. Reston, Va.: National Association of Secondary School Principals, 1986.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Technical Manual*. Reston, Va.: National Association of Secondary School Principals, 1988.

Kirby, J. R., and Das, J. P. "Reading Achievement, IQ, and Simultaneous-Successive Processing." *Journal of Educational Psychology* 69(1977):564–70.

Krywaniuk, L. W. *Patterns of Cognitive Abilities of High and Low Achieving School Children*. Ph.D. dissertation, Department of Educational Psychology, University of Alberta, Edmonton, Canada, 1974.

Luria, A. R. *The Working Brain*. London: Penguin, 1973.

Russell, P. *The Brain Book*. New York: Hawthorne Books, Inc., 1979.

Sprecht, H. *Simultaneous Successive Processing, Mathematics and Reading Achievement in Low Achieving High School Students*. Edmonton, Canada: Centre for the Study of Mental Retardation, University of Alberta, 1976.

Simultaneous Processing Skill

(See Sequential Processing for related references)

Keefe, J. W., and Monk, J. S. *Learning Style Profile Technical Manual*. Reston, Va.: National Association of Secondary School Principals, 1988.

Samples, R. *Open Mind, Whole Mind*. Rolling Hills Estates, Calif.: Jalmar Press, 1987.

Memory Skill

Atkinson, R.C., and Raugh, M.R. "An Application of the Mnemonic Key-Word Method to the Acquisition of a Russian Vocabulary." *Journal of Experimental Psychology: Human Learning and Memory* 104(1975):126-33.

Gardner, R. W.; Jackson, D. N.; and Messick, S. J. "Personality Organization in Cognitive Controls and Intellectual Abilities." *Psychological Issues*, New York: International Universities Press, Inc., 1960.

Holley, Charles D., and Dansereau, D. F. *Spatial Learning Strategies*. Orlando, Fla.: Academic Press, Inc., 1984.

Holzman, P. S. "The Relation of Assimilation Tendencies in Visual, Auditory, and Kinesthetic Time-Error to Cognitive Attitudes of Leveling and Sharpening." *Journal of Personality* 22(1954):375–94.

Holzman, P. S., and Gardner, R. W. "Leveling—Sharpening and Memory Organization." *Journal of Abnormal and Social Psychology* 61(1960):176–80.

Holzman, P. S., and Klein, G. S. "Cognitive System-Principles of Leveling and Sharpening: Individual Differences in Assimilation Effects in Visual Time-error." *Journal of Psychology* 37(1954):105–22.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Examiner's Manual*. Reston, Va.: National Association of Secondary School Principals, 1986.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Technical Manual*. Reston, Va.: National Association of Secondary School Principals, 1988.

Kennett, L. *For the Duration*. New York: Charles Scribner & Sons, 1985.

Lorayne, H., and Lucas, J. *The Memory Book*. New York: Ballantine Books, 1974.

Mayer, R. E. *Educational Psychology: A Cognitive Approach*. Boston: Little, Brown and Co., 1987.

Pressley, M., and Levin, J.R. "Developmental Constraints Associated with Children's Use of the Key-Word Method of Foreign Language Vocabulary Learning." *Journal of Experimental Child Psychology* 26(1978):359-72.

Russell, P. *The Brain Book*. New York: Hawthorn Books, Inc., 1979.

Santostefano, S. *Cognitive Control Therapy with Children and Adolescents*. New York: Pergammon Press, 1985.

Verbal-Spatial Preference

Cronbach, L. J., and Snow, R. E. *Aptitudes and Instructional Methods*. New York: Irvington Publishers, 1977.

Keefe, J. W., and Monk, J. S. *Learning Style Profile Technical Manual*. Reston, Va.: National Association of Secondary School Principals, 1988.

APPENDIX A

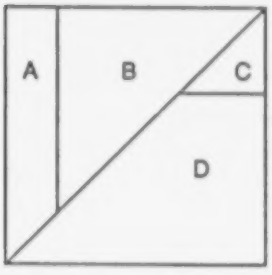
KEY TO PERFORMANCE ACTIVITIES

This key includes only a select group of activities whose answers are either not obvious or are slightly complicated. Other activities that have several (fairly obvious) solutions are not listed here.

Page

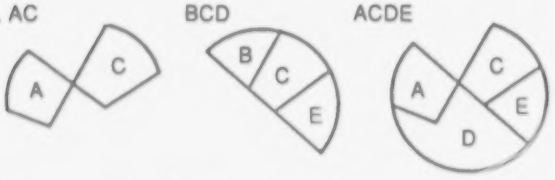
2 **Analytic Skill: Identifying and Labeling**

1.

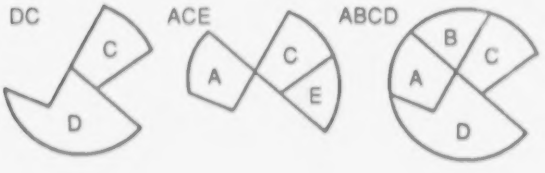


or any similar approach.

2. AC BCD ACDE



DC ACE ABCD



3.

A C D A B B C D

Page

2 4. Any systematic approach is acceptable.

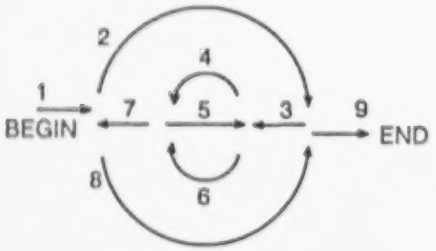
7 **Analytic Skill: American History Case Study Questions–Some points to consider:**

1. The Puritans expected perfection. They believed that religious perfection could not be achieved within a hierarchical church, and that the source of perfection was the self, not an outside group.
2. In their search for perfection, the Puritans established their church, government, and school all in one building, with local control by a Puritan elect. They believed that a theocracy or union of church and state represented the early Christian experience and best promoted personal perfection.
3. The Puritans were forced to make accommodations in their quest for perfectionism because of the hardships they faced in their battle for survival in the new land, their conflicts over territory with the Indians, the defeat of the Puritan Commonwealth in England, the rise of a successful merchant class, the isolation of their settlements in the west, and the declining fervor of the younger generation.
4. The Puritans were elitists who saw themselves as perfect and chosen by God to lead. They viewed the Indians as less than perfect. They would have defended their treatment of the Indians as justified by insisting that God wanted the perfect ones to control the land and that the Indians had no right to it.

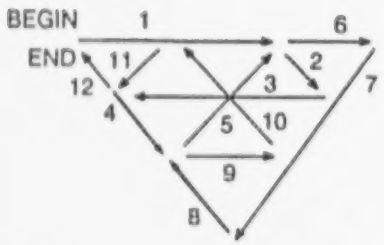
Page

10 Spatial Skill: Spatial Thinking

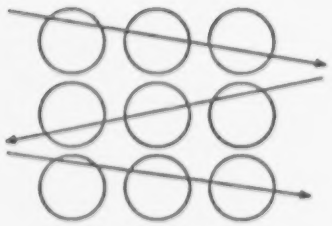
1.



2.



3.



11 Spatial Skill: Line Symmetry

1. Yes (Horizontal)
2. No
3. Yes (Vertical)
4. Yes (Vertical)

12 Spatial Skill: Pattern Recognition

1. 6
2. 6
3. 16

13 Spatial Skill: Cubes

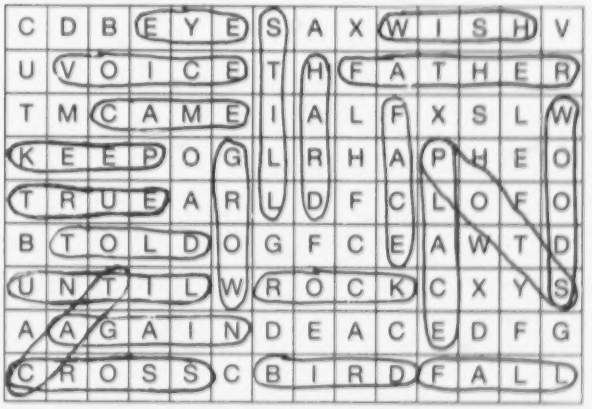
1. Same
2. Different
3. Same
4. Same
5. Different
6. Different
7. Same
8. Different

Page

18 Discrimination Skill: Visual Attention

1. S	2. S	3. S	4. S
5. B	6. S	7. S	8. S
9. B	10. =	11. B	12. S
13. B	14. B	15. B	16. =

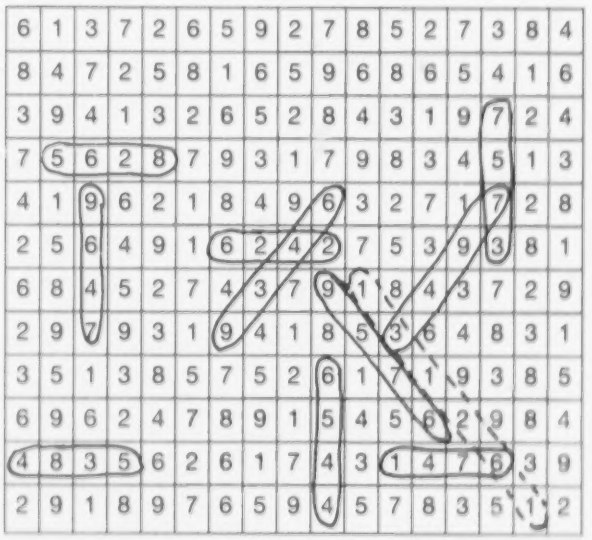
21 Discrimination Skill: Hidden Words



C	D	B	E	Y	E	S	A	X	W	I	S	H	V	
U	V	O	I	C	E	T	H	F	A	T	H	E	R	
T	M	C	A	M	E	I	A	L	F	X	S	L	W	
K	E	E	P	O	G	L	R	H	A	P	H	E	O	
T	R	U	E	A	R	L	D	F	C	L	O	F	O	
B	T	O	L	D	O	G	F	C	E	A	W	T	D	
U	N	T	I	L	W	R	O	C	K	C	X	Y	S	
A	A	G	A	I	N	D	E	A	C	E	D	F	G	
C	R	O	S	S	C	B	I	R	D	F	A	L	L	

21 Discrimination Skill: Hidden Numbers

A.

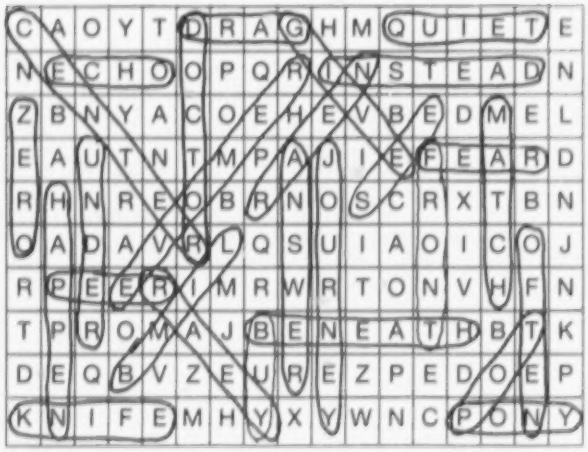


6	1	3	7	2	6	5	9	2	7	8	5	2	7	3	8	4
8	4	7	2	5	8	1	6	5	9	6	8	6	5	4	1	6
3	9	4	1	3	2	6	5	2	8	4	3	1	9	7	2	4
7	5	6	2	8	7	9	3	1	7	9	8	3	4	5	1	3
4	1	9	6	2	1	8	4	9	6	3	2	7	1	7	2	8
2	5	6	4	9	1	6	2	4	2	7	5	3	9	3	8	1
6	8	4	5	2	7	4	3	7	9	1	8	4	3	7	2	9
2	9	7	9	3	1	9	4	1	8	5	3	6	4	8	3	1
3	5	1	3	8	5	7	5	2	6	1	7	1	9	3	8	5
6	9	6	2	4	7	8	9	1	5	4	5	6	2	9	8	4
4	8	3	5	6	2	6	1	7	4	3	1	4	7	6	3	9
2	9	1	8	9	7	6	5	9	4	5	7	8	3	5	1	2

B. Dotted lines in lower right.

Page

22 Discrimination Skill: Hidden Meanings



Can you find words that mean:

1. response to a question—ANSWER
2. under something—BENEATH
3. to purchase—BUY
4. the middle of—CENTER
5. one who helps you when you are sick—DOCTOR
6. to pull along—DRAG
7. the repetition of a sound—ECHO
8. be afraid of—FEAR
9. beginning of the line—FRONT
10. to make a present of—GIVE
11. to occur or come about—HAPPEN
12. in place of, rather than—INSTEAD
13. trip—JOURNEY
14. a cutting instrument—KNIFE
15. branch of a tree—LIMB
16. a thing exactly like another—MATCH
17. close to—NEAR
18. many times—OFTEN
19. small horse—PONY
20. calm, little noise—QUIET
21. take away—REMOVE
22. to look at—PEER
23. the highest point—TOP
24. below something—UNDER
25. to pay a call upon—SEE
26. 12 months—YEAR
27. nothing—ZERO

Page

23 Discrimination Skill: Charted Information

1. Atlanta, Billings, Bismarck, Casper, Columbia, S.C., Denver, Des Moines, Evansville, Kansas City, Las Vegas, Little Rock, Minneapolis-St. Paul, Nashville, New Orleans, North Platte, Omaha, Phoenix, Rapid City, Reno, Sacramento, St. Louis, Salt Lake City, Sioux Falls, Topeka, Tucson, Wichita
2. Duluth, Flagstaff
3. Concord, N.H.
4. 101/77
5. 92/71, Cloudy
6. Auckland, Brussels, Buenos Aires, Frankfurt, Santiago, Sydney
7. 66/57, Cloudy
8.

	Lows	*Highs*
Brussels	46	70
New Delhi	76	90

25 Discrimination Skill: Pictorial Stock Market Report

1. Imported Car Co., A and L Auto, Wheels Inc., Fast Pedal Inc.
2. Zanith TV, Eyeball TV, RTA
3. General Reflective, Kil-O-Wat Co., Brown-Out Inc., Power Authority
4. Green Grocers, Mall Grocers, Buy-Here Food, Starr Food
5. All except Kil-O-Wat Co.
6. Imported Car Co., Green Grocers, Zanith TV, Mall Grocers, Eyeball TV, Fast Pedal Inc., RTA
7. General Reflective, A and L Auto, Kil-O-Wat Co., Wheels Inc., Buy-Here Food, Eyeball TV, Starr Food, Brown-Out Inc., Power Authority
8. Kil-O-Wat Co., Buy-Here Food, Power Authority
9. Mall Grocers, RTA
10. Green Grocers, Buy-Here Food, Starr Food, Fast Pedal Inc.

Page

28 Categorization Skill: Differences

1. From *hot* to *cold*
   - 2 sunshine
   - 5 ice cube
   - 3 water
   - 4 chilly
   - 1 flame

2. From *big* to *little*
   - 2 gorilla
   - 5 bee
   - 3 boy
   - 1 skyscraper
   - 4 dog

3. From *slow* to *fast*
   - 5 moving car
   - 2 turtle
   - 4 rabbit
   - 3 fish
   - 1 glacier

4. From *young* to *old*
   - 4 grandmother
   - 2 colt
   - 5 fossil
   - 3 bird
   - 1 infant

28 Categorization Skill: Alphabetizing

1. Again, big, fork, good, hen, kind, new, play, put, step, take, wood

2.

List 1	*List 2*	*List 3*
2 anxious	1 exercise	3 probably
1 ancestors	2 expected	2 price
5 broader	6 figure	1 pressed
3 breeze	3 failed	6 refuse
6 brushed	7 filtered	7 remaining
4 brilliant	8 furniture	5 recognized
8 choice	5 fawn	8 restocked
10 collie	4 faucets	4 realized
7 charged	10 future	10 shy
9 coal	9 fuse	9 shocks

Page

32 Categorization Skill: Word List Category Chart

CATEGORIES							
Nouns	*Verbs*	*Pronouns*	*Adjectives*	*Conjunctions*	*Prepositions*	*Interjections*
pigeon	tripped	they	violent	and	behind	wow
t-shirt	listen	you	mysterious	but	off	yeah
slogan	overslept	their	tiny	or	onto	ugh
Alice	flipped	I	red		over	oh
alley	skidded	he	off		throughout	
scarf	prowl	she				
coach	rush					
	swerved					

Page

33 Categorization Skill: Creating Categories

The four lists can be broken down into at least eight (8) categories: Life Sciences (LS), Physical Sciences (PS), Descriptive (Factual) Processes of Learning (DP), Inferential (Deductive) Processes of Learning (IP), Basic Concepts of Science (BC), Advanced Concepts of Science (AC), Language Arts Skills (LA), and Types of Literature (TL). The more obvious categorizations are listed below.

LIST 1	*LIST 2*	*LIST 3*	*LIST 4*
Analyzing (IP)	Astronomy (PS)	Botany (LS)	Acting (LA)
Biology (LS)	Cycle (BC)	Chemistry (PS)	Aerospace (PS)
Cause-Effect (BC)	Designing (IP)	Essay (TL)	Energy (BC)
Change (BC)	Drama (TL)	Identifying (DP)	Observing (DP)
Classifying (DP)	Hypothesizing (IP)	Inferring (IP)	Oceanography (LS)
Defining (DP)	Measuring (DP)	Interpreting (IP)	Physics (PS)
Evolution (AC)	Meteorology (PS)	Matter (BC)	Predicting (IP)
Geology (PS)	Novel (TL)	Non-fiction (TL)	Questioning (IP)
Poetry (TL)	Organism (AC)	Relativity (AC)	Researching (DP)
Psychology (LS)	Physiology (LS)	Spelling (LA)	Short Story (TL)
Reading (LA)	Population (AC)	System (AC)	Space-Time (BC)
Speaking (LA)	Writing (LA)	Zoology (LS)	Universe (AC)

37 Sequential Processing Skill: Area of Circles (A)

1. 3.14 in.; 7.98 cm.
2. .785 in.; 1.99 cm.
3. .19625 in.; .499 cm.
4. 1.766 in.; 4.49 cm.

Page

38 Sequential Processing Skill: Area of Circles (B)

1. 314 yards
   $c = \pi \times d$
   $c = 3.14 \times 100$ yd.
   $c = 314$ yd.
2. Because the two formulas are the same.
   $A = b \cdot h$
   $A = \pi r^2$
3. Radius = 50 yards
   Area = 7850 sq. yds.
   $A = \pi r^2$
   $A = 3.14 \times 50 \times 50$
   $A = 7{,}850$ sq. yd.
4. Area = 28.26 sq. ft.
5. Area = 2461.76 sq. ft.
6. Area = 38.47 sq. ft.
7. Radius = .88 ft.; Area = 2.43 sq. ft.
8. Radius = 1.15 ft.; Area = 4.15 sq. ft.
9. Radius = 15 ft.; Area = 706.5 sq. ft.
10. No
11. No–It is quadrupled.
12. No–You get 4 times as much pizza.

Table 2

Pizza	Radius	Area
8-inch	4 in.	50.24
16-inch	8 in.	200.96

13. Circumference = 628 inches
    Area = 31,400 sq. in.
    $c = \pi \times d$
    $c = 3.14 \times 20$
    $c = 628$ in.
    $A = \pi r^2$
    $A = 3.14 \times 100 \times 100$
    $A = 31{,}400$ in.

Page

40 **Sequential Processing Skill: Chemistry-Tomato Experiment Hints.**

A. Weigh the tomato before proceeding. Then pulverize the tomato in the food mill or blender. Strain the liquid into the beaker using a *metal* strainer that will not absorb the liquid. Spread the remaining moist solid on the weighed aluminum foil for drying.

B. To account for evaporated water, first weigh the aluminum foil for its weight without the tomato mash. Then weigh the foil plus the moist mash before any evaporation has taken place. When all the water has evaporated, weigh the foil and mash again. The weight of the evaporated water is the weight of the moist mash minus the dry mash minus the weight of the foil.

C. Add the weight of the strained water in (A) above to the weight of the evaporated water in (B) to compute the total weight of the water by mass. Weigh the dry tomato mash and subtract the weight of the aluminum foil. Add the weight of the water and the dry tomato mash and compare it with your opening weight to see if any mistakes were made in weighing or calculating. Finally, compute the percent of water by mass in the tomato by this formula:

$$\frac{\text{weight of water}}{\text{weight of tomato}} \times 100\%$$

APPENDIX B

NASSP Learning Style Profile Interpretation Form

NAME _____ DATE _____ GRADE _____

NASSP LEARNING STYLE PROFILE INTERPRETATION

COGNITIVE SKILLS—General approach to processing information

	WEAK	AVERAGE	STRONG
ANALYTIC—The ability to identify simple figures hidden in a complex field; to analyze information; to use the critical element of a problem in a different way. Most school-related achievement requires this skill. Related to algebra and natural science courses. (Items 25–29)			
SPATIAL—The ability to identify a geometric shape, remember it, and discriminate it from other similar patterns. Also, the ability to rotate objects in the imagination. Related to geometry, drafting, physics, art, engineering, and architecture. (Items 36–40)			
DISCRIMINATION—The ability to visualize the important elements of a task; to focus attention on required detail and avoid distractions; to do what is asked. (Items 7–11)			
CATEGORIZATION—The ability to take some risk in classifying information, using reasonable (vs. vague) criteria to form accurate, complete, and organized categories. Narrow categorizers use more complete, accurate categories to classify information. Broad categorizers lack accuracy and organization in these tasks. (Items 17-24)			
SEQUENTIAL PROCESSING—The ability to process information sequentially taking items one step at a time. The ability to perceive the separate elements of experiences; to respond to information verbally. Related to linear tasks (2 + 2) and verbal skills (reading or language arts). Example: Being able to put a bike together *after* reading the manufacturer's directions. (Items 1–6)			
SIMULTANEOUS PROCESSING—The ability to respond to new information visually and spatially; to grasp the entire meaning of an experience at once; to perceive the separate elements of a whole and see the bigger picture when only parts are available. Example: Being able to put a bike together *without* reading the manufacturer's directions first. (Items 12–16)			

MEMORY—The ability to remember discrete bits of information; to detect and remember subtle changes in information. Highly related to school learning; recalling formulas, vocabulary drills, spelling, and many of the basic skills of language and math. (Items 109, 110, 112, 114, 116, 118, 119, 120, 121, 123, 124, 126)

PERCEPTUAL RESPONSES —Initial response to information

WEAK	AVERAGE	STRONG

VISUAL—Preference for processing information initially by seeing it. Those who are strong visual learners prefer visual, pictorial, or graphic representations. They often close their eyes to reconstruct a picture of what they are trying to remember. (Items 41–60 / A)

AUDITORY—Preference for processing information initially by hearing it. Those who are strong auditory learners like to listen to others talk about experience. They often repeat to themselves whatever they are trying to learn. Extraneous sound and noises are distracting to them because they tend to respond to all sounds. (Items 41–60 / B)

EMOTIVE—Preference for processing information initially by reacting with feeling. The response of strong emotive learners is emotional and/or physiological; i.e., becoming angry, calm, happy, tense, etc. (Items 41–60 / C)

STUDY AND INSTRUCTIONAL PREFERENCES—Personal preferences for the motivational or environmental elements of style

LOW	AVERAGE	HIGH

PERSISTENCE ORIENTATION—Willingness to work at a task beyond the required time, to withstand discomfort, and to face the prospect of failure. The high persistent learner works at a task until completed, seeking whatever help is needed to persevere. The low persistent learner usually has a short attention span and gives up easily on demanding tasks. (Items 64, 74, 84, 91)

VERBAL RISK ORIENTATION—Willingness to verbalize, to state opinions even if others disagree. Verbal risk-oriented learners are comfortable speaking out and defending their thoughts and ideas. They do well in small groups and make good debaters. (Items 75, 92, 95, 107)

MANIPULATIVE PREFERENCE—Preference for learning or instruction through hands-on activities. Manipulative learners like to build, fix, make, or put things together. (Items 64, 73, 82, 102)

TIME PREFERENCE—Preference for studying and learning:
- in the early morning. (Items 72, 106)
- in the late morning. (Items 89, 93)
- in the afternoon. (Items 94, 100, 104)
- in the evening. (Items 62, 66, 77)

VERBAL SPATIAL PREFERENCE—Preference for learning or instruction through verbal or spatial activities. (Items 30–35)

HIGH SPATIAL	NEUTRAL	HIGH VERBAL

GROUPING PREFERENCE—Preference for learning or instruction in whole class, small group, or with one other student. (Items 65, 70, 83, 90, 99)

SMALL		LARGE

POSTURE PREFERENCE—Preference for formal vs. informal study arrangements. (Items 79, 87, 97, 105)

INFORMAL		FORMAL

MOBILITY PREFERENCE—Preference for moving about and taking breaks while studying vs. studying in one place until the task is finished. (Items 76, 86, 103, 108)

STILLNESS		MOVEMENT

SOUND PREFERENCE—Preference for a quiet study area vs. one with background sound (radio, T.V.). (Items 71, 78, 81, 101)

QUIET		SOUND

LIGHTING PREFERENCE—Preference for a bright vs. lower lighted study area. (Items 61, 67, 69, 80, 98)

DIM		BRIGHT

TEMPERATURE PREFERENCE—Preference for studying in a warm vs. a cool environment. (Items 63, 85, 88, 96)

COOL		WARM

nassp
1904 Association Drive
Reston, Virginia 22091-1598